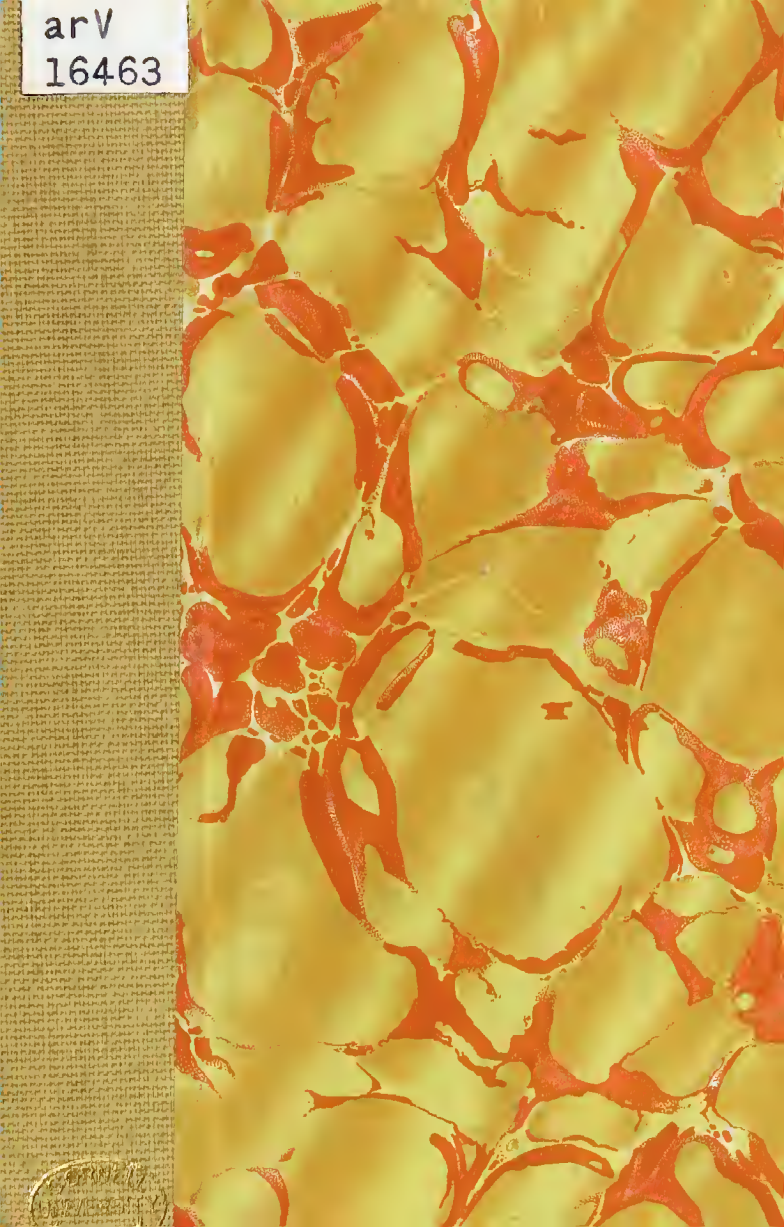


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Technical Education.

A Summary of the Report

OF THE

ROYAL COMMISSION

Appointed to Inquire into the State
of Technical Instruction.

BY

F. C. MONTAGUE, M.A.

WITH A PREFACE BY

SIR BERNHARD SAMUELSON, BART., M.P.,

CHAIRMAN OF THE COMMISSION.



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TECHNICAL EDUCATION.

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1887

PREFACE.

BY SIR BERNHARD SAMUELSON, BART., M.P.,

Chairman of the late Royal Commission on Technical Instruction.

My friend, Mr. William Rathbone, at whose request the following digest of the Report of the Technical Instruction Commission has been prepared, has asked me to prefix to it, by way of preface, such observations on the subject as may appear to me to be useful at the present time. Perhaps I cannot do better than to summarise the conclusions and recommendations of the Commission in the fewest words: to state how far they have been complied with by the Government, and to add some information as to what has been done during the progress, and since the conclusion of our inquiry, towards remedying in various other ways the deficiencies which it disclosed.

Dividing the subject into the three heads of the technical instructions of (1) the proprietors and principal managers of industrial works, (2) the foremen, and (3) the workmen, we found that the education of the first was provided for on the Continent in a way beyond all comparison more complete and effective than in this country, and that this applied as much to their commercial as to what is usually understood by their technical education. The defects of the latter in our case were more conspicuous in the more refined chemical manufactures than in mechanical engineering. In reference to the second class, we found that, whilst there are on the Continent, and more especially in France, a limited number of establishments designed for the systematic training of foremen in mechanical engineering, and in some other branches of manufacturing, and in Germany schools for instruction in the principles of textile manufactures and dyeing, on the other hand, the instruction afforded by classes in connection with the Science and Art Department of South Kensington, supplemented by those of the City Guilds, covers a wider area of elementary, and what

may be distinguished as lower secondary scientific and technical instruction, in this than in any other country. To this provision, however, instruction in art, in view of its application to industry, forms an exception. This latter we found, partly by reason of its gratuity, far more widely diffused in France and Belgium than amongst ourselves. Lastly, as to the instruction of the artizans, we found that their defective elementary instruction in this country, as compared with that of the corresponding class in Germany and Switzerland, and latterly in the principal cities of France, prevented our people from availing themselves of the opportunities which the science classes already referred to would otherwise afford them. At the same time, we ascertained that it was a fallacy to suppose that the workpeople of foreign countries (again excepting as to art) have received a better technical education than our own. The contrary rather is the case, thanks to the training which our people have received for several generations in our workshops.

At the same time, we found that the technical skill of foreign artizans was rapidly increasing. We observed that elementary instruction in the use of tools for working in wood and iron was being introduced into the principal elementary schools of France, and that under the name of higher elementary schools gratuitous technical schools rendered available by bursaries to artizans for their more advanced technical instruction had been and were being set up in many French cities. We did not approve of the French schools which profess to give instruction to artizans in mechanical engineering and the other more important handicrafts, as a substitute for apprenticeship in the workshop, but we recognised the advantage of the schools in some poor and remote parts of the Continent, which afford instruction in such domestic employments as wood-carving and lace-making as a means of procuring some slight addition to the precarious and slender income of families in those districts, and it appeared to us that the circumstances of Ireland might render such instruction very useful in some parts of that country.

As the result of our inquiries, we were induced to make the following, amongst other recommendations:—As to elementary schools, that drawing should be taught systematically in all of them; that no school should be considered efficient in which proper appliances—such as casts and models, &c.—for this purpose were not provided; that the limits of age and acquire-

ments authorising the employment of the whole time of children in labour should be raised in England and Ireland to the standard of Scotland; that proficiency in the use of tools for working in wood and iron should be recognised as a "specific subject;" that in rural schools the principles and facts of agriculture should be taught to the older children.

As to science and art schools, we recommended that local authorities should have power to establish them and to contribute to their maintenance; that the inspection exercised by this department should be more efficient; that greater encouragement should be given to industrial designing; that the building grants should be more liberal; that grants should not be conditional on the payment of fees by all the students in science and art classes, but that artizans might be admitted to them gratuitously.

We desired that science should be more efficiently taught in the training colleges for teachers, and that the students in these colleges should be allowed to avail themselves fully of the instruction in art and science to be obtained in the Government schools of South Kensington and Dublin.

We recommended the liberal application of ancient endowments to secondary schools in which so-called modern subjects should take the place of the classics; - that power should be given to local authorities to establish schools of this kind; and that the existing restrictions with reference to the establishment of free public libraries and museums should be removed.

These, and some special recommendations in regard to Ireland, relating to instruction in home industries, to grants in aid of agricultural schools, and to the functions of the Royal College of Science in Dublin, were our chief demands, so far as they depend on the action of the Government and of public authorities.

In addition, we considered ourselves justified in hoping that there would be greater liberality than heretofore on the part of private individuals in the provision of scholarships in technical and other secondary schools for the more promising pupils of elementary schools; that employers and Trades Unions would give greater encouragement to, and, if necessary, insist on, young persons employed in manufactures and handicrafts availing themselves of instruction in science and art classes; that the managers of such classes would encourage more systematic and advanced instruction; and that the great

national agricultural societies would promote the establishment of schools in which agriculture is taught.

Successive Ministers of Education have in various ways shown that they concur, on the whole, with our demands; but, with the exception of drawing having, under difficulties on the part of the Treasury, been made a class subject in elementary schools, and of more stringent requirements on the part of the Science and Art Department in reference to practical work in the science classes, the Government did not feel itself sufficiently supported by public opinion to give effect to our recommendations until the present session. The Bill for the establishment of technical schools, introduced a few nights ago by the Vice-President of the Council, encourages those who have for so many years laboured perseveringly in the promotion of technical instruction to hope that some real progress will at length be made, not only in a few favoured places, but throughout the length and breadth of the land. The intention of its authors is to give effect to our recommendations so far as they relate to elementary and secondary technical instruction. It is to be hoped that the power to be granted by it to local authorities will not be hampered with unnecessary restrictions. Those conferred on the Science and Art Department are ample, and I believe it has every disposition to exercise them liberally if it can rely on the support of the country and of the House of Commons. A few of the City Guilds, and notably the Clothworkers' Company, have shown great liberality in the judicious provision of funds for the encouragement of technical instruction, and I see no reason why, in the case of those Companies who now devote their incomes to less useful purposes, a fair contribution to what is properly their work should not be insisted on, in aid of schools maintained jointly by the localities in which they are situated and by the State through the agency of the Science and Art Department.

Several such schools are now in good working order. Amongst these are the Technical Schools of the City Guilds in Finsbury, the day and evening classes of which are full to overflowing. The Technical College at Bradford, assisted by the Clothworkers' Company, is in full activity in all its departments. The courses of the dyeing school, conducted by an energetic young professor trained at Zurich, are followed both by middle-class and artizan students; and the weaving department is attracting students even from Germany.

The Bristol Trade School, erected and maintained by the liberality of the Merchant Adventurers' Guild of that city, intended chiefly for the instruction of chemists, engineers, and miners, is well equipped, both as regards its staff and its laboratories. The school at Keighley is a conspicuous example of a good science school. The Heriot-Watt School of Edinburgh, the Glasgow and West of Scotland College, and the Manchester Technical School, are old schools amalgamated or otherwise reorganised. I name these as instances of the higher elementary and secondary technical schools which are already in operation in various parts of the country. As yet they are few ; but in Stockport, Blackburn, Wakefield, Preston, Hull, and in several other towns, similar schools are either being established, or the proposal to establish them has been warmly taken up, and is likely to lead to practical results.

Elementary instruction in the use of tools has been introduced tentatively in some of the London Board Schools, successfully in Sheffield and elsewhere.

The signs of progress in the highest technical instruction are less hopeful. The Central Institute of the City Guilds, in the Exhibition Road, has an ample provision of professors and of laboratories and class-rooms ; but its students are not till now so numerous as might have been wished and expected, even making allowance for the short time that it has been opened ; and the various local University Colleges are, with some few exceptions, inadequately provided with funds and not very numerously frequented. It will be seen from the digest of our Report how munificently colleges of similar and of higher rank are supported by the Governments of continental countries. The highest technical instruction is not—and probably never will be—self-supporting in any country ; and if, in consideration of the exceptionally liberal contributions of the State with us to elementary instruction—which in Germany and Switzerland is defrayed almost exclusively from local funds—we can scarcely expect that as much will be done here as in those countries out of Imperial funds for this important—perhaps the most important—grade of technical education, some assistance may be fairly asked for from Government, and will not, I believe, be asked for in vain when it shall appear that there is a genuine demand and sufficient preparation for instruction of this advanced type.

A branch of the subject not less important, though, as I

have said elsewhere, it has not hitherto been regarded as strictly within the lines of technical instruction, is that of commercial education. Our youths are far behind those of Germany in the cultivation of modern languages, arithmetic, and geography. The Oxford and Cambridge Local Examination Board has recently devised and submitted to the Chambers of Commerce a special scheme of examination in these subjects, which it is to be hoped will act as a stimulus on the secondary schools.

Amongst the encouraging signs of the interest taken in technical instruction, I would mention the recent establishment of an association for its promotion which owes its inception to Sir Henry Roscoe and Mr. Arthur Acland, and of which Lord Hartington is the President. Its chief objects are to stimulate public interest in the subject, to assist local bodies with its advice, and to take Parliamentary action in the direction in which legislation is required.

I will conclude this somewhat hasty review with an expression of the hearty wish that our people throughout the country may at length arrive at a full sense of our educational deficiencies, and at the determination that they shall cease to exist.

B. SAMUELSON.

July 20, 1887.

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TECHNICAL EDUCATION.



I.—INTRODUCTION.*

DURING the first half of this century we enjoyed an unchallenged industrial supremacy, the result of many contributory causes. Among them were physical causes, such as our mineral wealth, our position, at once safe and accessible, our prolonged seaboard, and our bracing climate; moral and intellectual causes, such as the natural energy and inventiveness of our people; political causes, such as the happy union of individual liberty with public order; economic causes, such as the gradual accumulation of capital in earlier times; and many other causes too numerous to be specified. Full scope for the operation of all these causes was given by the long Napoleonic war which devastated the Continent, whilst it left us in secure isolation to perfect our manufactures, and to grasp the carrying trade of the world. So conspicuous was the supremacy thus established that some among us came to regard it almost as part of the fixed order of Nature. These good people took the same view respecting their country which a Sheffield manufacturer expressed respecting his town:—"Sheffield was really a very fine town, and he questioned whether any part of the world was equal to it." Although conceivably we might improve ourselves, yet we were so superior to other nations that improvement was hardly a thing of practical concern. Nay, there was some fear of doing harm in the rash attempt to ameliorate that which was already so excellent. In this frame of mind, our

* The Commissioners and the Report referred to in these pages are invariably the Commissioners appointed to inquire into technical instruction, and the second Report prepared by them. The Report itself may be purchased either directly or through any bookseller from any of the following agents:—Messrs. Hansard and Son, 13, Great Queen Street, W.C., and 32, Abingdon Street, Westminster; Messrs. Eyre and Spottiswoode, East Harding Street, Fleet Street, and Sale Office, House of Lords; Messrs. Adam and Charles Black, Edinburgh; Messrs. Alexander Thom and Co., or Messrs. Hodges, Figgis, and Co., Dublin.

industrial classes were little disposed to vex their souls with problems of technical education.

Our neighbours, however, saw things more clearly. The industrial supremacy of Great Britain appeared to them the effect of definite causes, not of an indefinite perfection in the British. They were inferior to us in material resources and in natural ingenuity; but their inferiority in these respects forced upon their attention the value of thrift and of education. Thrift multiplied their capital, and education multiplied their industrial efficiency. England served them as a model of organisation and equipment; but their trained intelligence enabled them to improve upon this model. For some time past, whilst we have advanced, they have advanced faster still; they have driven us from several of their domestic markets, and they are sharply competing with us in the markets of other nations. We find that our industrial empire is vigorously attacked all over the world. We find that our most formidable assailants are the best educated peoples. Upon this matter let us listen to the testimony of an Englishman, for thirty years manager in a Bavarian engineering works:—

“Germany thirty years ago, as compared with England, was simply nowhere; but placing English and German workshops side by side now, we should find that the progress in the latter had been positively marvellous. During all these years the Germans had been following the English step by step, importing their machinery and tools, engaging, when they could, the best men from the best shops, copying their methods of work and the organisation of their industries; but, besides this, they had devoted special attention to a matter which England had almost ignored: the scientific or technical instruction of their own people. And what has been the result of all this? They have reached a point at which they have little to learn from the English.”—“Report,” Vol I., p. 335.

This testimony was confirmed by the observation of the Commissioners themselves. In their description of a visit to the factories of Alsace, they tell us that

“Our rivals have possessed themselves outwardly of all the advantages and excellences which have been the growth of English inventiveness and enterprise during the last generation. To the casual observer, strolling from room to room, and watching the varying processes from the soft white sliver to the ‘built up’ cop of yarn, there would not appear to be a very appreciable difference between a German and a Lancashire factory. The raw material, machinery, and appointments, are equal in both cases. In general appearance the operatives do not compare unfavourably with those of Lancashire.”—“Report,” Vol I., p. 295.

We know to our cost that the equality of English and German manufacturers is sometimes real as well as apparent. Thus, weaving firms in the Saxon town of Chemnitz send their fancy goods to London, Bradford, or Manchester, and sell them in the very centres of competition. Similar instances could be drawn from other industries.

The success of our rivals is not to be explained by reference to the low wages and long hours of work general on the Continent. If labour is cheaper there, coal is dearer, machinery is dearer, and imported raw material often pays a tax. Moreover, the artisans abroad have not the energy of our own men, who eat better and more abundant food, and have more rest. The foreign employers questioned by the Commissioners allowed that for strength and spirit the English operative was unrivalled. Some of them thought that they should ultimately gain by such a rise in wages and curtailment of work as would improve the health and strength of their own hands. The Commissioners expressly state that the foreign competition which presses us most seriously is more frequently that in which the conditions of hours and wages approach nearest to those prevailing here. In so far as the competition between ourselves and foreign nations depends on the workman, it is mainly the sobriety and the intelligence of their workmen which give them the advantage. But in that competition it is not only the intelligence of the workman; it is the intelligence of the foreman, the manager, the master, nay, it is the intelligence of the whole people, which is of so much weight.

Let us dwell a little longer upon this point, for it is one of supreme consequence to ourselves. We have begun to see the commercial value of elementary and of technical education. But our perception of their commercial value will not help us unless it is joined to a perception of their place and relations in the whole scheme of enlightenment. We must again and again repeat that neither elementary education nor technical education can be perfected apart from education in general, or could by themselves have made Germany so puissant a rival as we now find her. The strength of Germany lies in the culture of every class of Germans, in the real love of learning which animates the people and their rulers, in the patient, inquiring, and scientific spirit which has transformed almost every branch of human activity from metaphysics to the art of war. This culture, this love of learning, this

scientific spirit, are not rare among us, but neither are they diffused; they are the property of individuals and of small groups. In Germany the problem how to educate the whole nation as well as possible has for many years been constantly present to the minds of scholars and statesmen. In England, and still more in Ireland, it is less the education of the people than the advantage which parties can draw from controlling education that has fascinated journalists and members of Parliament. Education, however, is too grave a concern to be dealt with by men who lack singleness of aim and purity of purpose. In spite of the growth of a genuine interest in the object, we are still far behind Germany in primary, in secondary, in university education, and therefore in technical education, which grows out of and always remains entwined with all three. The education of a people is a whole, and has a unity. Technical education, the education which makes a man expert in his calling, has its allotted place in that wider education which makes him a worthy member of a civilised commonwealth. The education which draws out all the intelligence of the community is a necessary antecedent to the education which draws out the capacity of this or that man for this or that calling.

Technical education falls into two great divisions: the education of those who will be engaged in manufactures, mining, building, and similar occupations; and the education of those who will be engaged in agriculture. Each of these principal divisions may again be subdivided into three grades: the primary, the intermediate, and the advanced. In each of these grades the instruction must be varied according to the nature of the particular branch of industry which is taught. From these considerations we may see how vast and intricate is the subject of technical education. Its full discussion would produce a large library of monographs which only experts could understand. But many persons beside experts are beginning to concern themselves in technical education, and for them a general survey of the field which it covers may be useful. Such a survey, based upon the results of long and laborious investigation, helps to show the ends at which we must aim, the results which we have already achieved, and the principles which should guide us in making good our deficiencies. In the hope of rendering this assistance to the public, the following abstract has been written.

II.—TECHNICAL INSTRUCTION IN MANUFACTURES, MINING, ETC.

A.—PRIMARY INSTRUCTION.

By primary instruction is here understood such technical instruction as is required by the ordinary artizan. The education of the artizan may be divided into the education given in the public elementary schools and the education given in schools purely technical. Accordingly, the Commissioners, in their inquiries and recommendations, constantly kept in view the state of elementary education. So much has recently been done to improve the elementary schools of this country that we are apt to think them even better than they are—to suppose them practically perfect. In truth, we have still many things to learn from countries where the school system has been maturing through a long course of years. If anybody questions this statement, let him take a favourable specimen of our public elementary schools, and compare it with the Swiss school of the same class, described in the following passage of the Report:—

“One of the best elementary Swiss schools visited by the Commissioners is that on the Lindescher Platz, in Zurich. The cost of building this school was £43,000, which amounts to £66 per head. Irregularity of attendance is practically unknown; all the children learn one foreign language; moreover, they are all taught drawing, and have object lessons in natural history. In the higher classes they are instructed in the rudiments of chemistry and physics, great pains being taken to place before the children well-arranged specimens, which are contained in a school museum. These museums form very noteworthy objects in the Zurich schools. Among the objects we found there were simple chemical and physical apparatus, chemical specimens, geographical relief maps showing the Alps and their glaciers, typical collections of commonly-occurring and useful rocks and minerals, excellent botanical models, as well as collections of insects, carefully labelled, a complete herbarium, zoological and anatomical specimens and models: the collection, in fact, serving as a type of what such a school museum should be. Many of the specimens were collected and arranged by the teachers.

“All the school subjects were taught intelligently and well. We were specially struck with the clean and tidy appearance of the boys, and there was a difficulty in realising that the school consisted mainly of children of the lower classes of the population.”—“Report,” Vol. I., p. 20.

The chief faults of our elementary school system are two—the average period of attendance at school is too short and the programme of school teaching is too meagre. It is convenient to examine these defects separately. In England a child can be compelled to attend school when it is five years old; but as soon as it has passed the Fourth Standard it may be employed for hire, and as soon as it has passed the Fifth Standard it is free from any obligation of further attendance.*

The Fourth Standard is ridiculously low, and an intelligent child, fairly well taught, can easily pass it at the age of ten years. Consequently, in those districts which especially concern us here, in the manufacturing districts, where the labour of children is valuable, almost every child has passed the Fourth Standard at that age, and thenceforward is employed half its time in the factories. It is plain to the meanest capacity that a child's education must be hindered by putting it to work as soon as it has completed its tenth year. The child, even when working half time, can usually pass the Fifth Standard in another year, and it is thus released from school when but eleven years old: that is to say, after a school life of six years. In Germany and Switzerland they order these things very differently. They act on the principle, admitted by everybody who knows or cares anything about education, that the way to secure a good training for the mind is not to end the school life as soon as the scholar can pass an examination, but to insist that every scholar shall spend a certain number of years under sound teaching. The period of compulsory attendance at school begins later and lasts longer there than here. In the city of Hamburg it commences at the age of six and continues for seven years; in the kingdom of Saxony it is practically the same. In Baden, Bavaria, Zurich, and elsewhere, young persons leaving the elementary school at the age of twelve, thirteen, or fourteen years, are required by law to attend the *Fortbildung*, or continuation schools, for two or three years more.

“These evening schools,” say the Commissioners, “help to sustain a boy's interest in study at a time when he is likely to forget what he has acquired in the ordinary primary school. For the want of them apprentices

* The age at which a child may be employed for hire is fixed by statute; the standard of total exemption from attendance at school is fixed by a bye-law of the School Board or School Attendance Committee, which has received the approval of the Education Department. In such bye-laws the Fifth Standard is usually but not always, selected as that of total exemption.

or young workmen frequently find themselves too ignorant to avail themselves of the special technical instruction which they have the opportunities of obtaining, and on this account, and also because they serve to give the youth a taste for study at the time when he begins to appreciate the value of instruction, these schools have proved to be most serviceable to German and Swiss artizans in quickening their intelligence, and in affording them useful information bearing upon their trades."—"Report," Vol. I., p. 37.

In Germany and Switzerland there are not only more years in the school life ; there are also more hours in the school day. Having thus secured the necessary time, the law lays down a more liberal programme of elementary instruction than the one adopted here. Examinations, developed here to the great detriment of primary as well as of advanced instruction, are there kept in their proper bounds. There is less "cramming," and the instruction is slower, more thorough, and more reasoned, than it can be under our system of hurrying children to the point where they may be rewarded by having their education cut short. To lengthen the school life is, therefore, the first reform needed in our school system. The Commissioners contented themselves with recommending that no child should be allowed to work half time before it had passed the Fifth Standard : practically, before it was eleven years old. This is a step in the right direction, perhaps as long a step as can be taken now ; but we must not fancy that even this change puts us on an equality with Switzerland or Germany. With us the period of compulsory attendance at school would still average only six years, and would still begin at an unusually early age. It is desirable that children under twelve years should not be employed in factories, and should be compelled to attend school without reference to the standard which they may have attained. Continuation schools, open in the evening, should be established throughout the country, and all persons under the age of fourteen years who are not attending other schools should be required to attend them. We have already seen the opinion of the Commissioners as to the service done by the Fortbildung schools in Germany and Switzerland. In this country they would be still more useful, inasmuch as children leave school in a less advanced stage of instruction. With us, the child who has attended an elementary school too often leaves it at that very period of life when the power of fixing the attention and the taste for knowledge begin for the first time to show themselves ; he goes back to a home without intellectual interests, where life is sacrificed

to getting a livelihood ; he spends his days in a narrow routine of mechanical labour and his evenings in utter listlessness, and, on reaching manhood, finds that he has lost, in great part, the rudiments which he so painfully acquired : that he is, if not exactly illiterate, yet unfit to make progress in any branch of knowledge which may relate to his calling. The true remedy is not to try to crowd much more into the short period of compulsory attendance at school, but to lengthen that period, whilst interfering with industry as little as possible. This can be done only by establishing evening schools to carry further the instruction given in the day schools.

In the second place—and this is a fault which naturally grows out of the fault first mentioned—our public elementary schools do not teach as much as the model artizan should know. There are, at least, three weak points in their system of instruction, as tried by this humble and practical test. Drawing is taught ill, the rudiments of natural science are taught slightly, and the use of tools is taught rarely. Each of these points demands separate consideration.

I. *Drawing*.—All experts are agreed that practice in drawing is valuable as a means both of general and of technical education. It imparts steadiness and delicacy to the fingers, it develops clear and exact perception, and it cultivates the sense of elegance and beauty, which, however feeble in most people, is wholly absent only from the lowest minds. A knowledge of drawing is useful in every handicraft, and indispensable in many. Yet it appeared, from the evidence given before the Commissioners, that drawing is not taught in more than a fourth of the elementary schools in England. Even in these schools it is not taught to every pupil. The teaching is generally bad, because the schoolmasters and schoolmistresses themselves have not been properly taught to draw. When the Commissioners drew up their report, the grant for drawing might be earned by a school which did not allot to the subject more than one hour a week ; but this miserable allowance has since been increased to one hour and a half. Formerly the examination in drawing was of the most futile character. A prodigious quantity of work was sent up from every part of the kingdom to South Kensington, and was there judged by the unhappy officials. It should be noted that the drawing in public elementary schools is in the charge, not of the Education Department, but of the Science and Art Department. By the same Minute,

which requires more time to be given to drawing, it is provided that the examination in drawing shall henceforward be held in the school itself by a local inspector or by his assistant. These changes are good, but they do not raise the instruction in drawing to the standard attained in France or Germany, nor do they fulfil the recommendations of the Commissioners. The Commissioners recommended :—(i.) That rudimentary drawing should be incorporated with writing as a single elementary subject, and that instruction in drawing should be continued through all the standards ; (ii.) that a proper supply of casts and models for drawing should be included in that “apparatus of elementary instruction” which a school must possess before it can receive public money ; (iii.) that modelling should be constituted a subject on which grants could be earned ; (iv.) that art should be properly taught in the training colleges to those who will subsequently have to teach art to others ; (v.) that the inspectors of the Education Department should be made responsible for the instruction in drawing given in elementary schools. To these recommendations may be added another, which they involve : namely, that the time given to drawing in the school programmes should be increased. Mr. Armstrong, the Director of Art for the Science and Art Department, thought that four hours a week should be allotted to drawing alone, before taking any time for such a subject as modelling. This once done, he thought that one hour a week for modelling would be time well spent. Drawing is not a sort of work which harasses or exhausts the mind, and, for its sake, the present school hours might, with advantage, be lengthened.

II. *Natural Science*.—In our infant schools the pupils have object lessons in natural science, and in our elementary schools certain sciences are class subjects, which may be taken up by scholars who have passed the lowest standards. Geography may, however, be regarded as a science, and geography may be taken as a class subject in the lower division of elementary schools. The Commissioners recommended that elementary lessons in natural science, including geography, should take the place now occupied by geography alone. The effect of this change would be to continue the object lessons in elementary science now given in the infant school up to the point at which they would be succeeded by definite teaching of special sciences, so that the impressions made upon very young children should not be allowed to vanish before they are old

enough to profit by higher methods of instruction. But when we try to develop the study of natural science in elementary schools, we are met with the same difficulties as in the case of drawing—the want of time, the want of money, and the want of well-trained teachers. Little science can be taught to backward children, whose school hours are so few. The cost of apparatus wherewith to illustrate lessons in natural science is more than most schools can afford. The teachers from the training colleges have often been “crammed” with science rather than disciplined in science. These difficulties, perhaps insuperable in country places, have been partially overcome in a few large towns by the employment of itinerant demonstrators, or by the foundation of higher elementary schools.

At Liverpool and Birmingham the itinerant demonstrator has proved useful. He works in unison with the teachers in the various elementary schools, and his demonstrations reinforce their lessons. The apparatus used in the demonstrations is kept at a central laboratory, and is transferred from school to school by means of a light hand-cart. The demonstrator visits each school once a week, giving in the week eighteen or twenty demonstrations. In the intervals between the demonstrations the teachers of the respective classes, who have themselves been present, go over the subject of the last demonstration, and frequently illustrate their lectures with simple experiments. For the help of the teachers there has been prepared a simple text-book, with reading lessons on the subjects of the demonstrations, and exercises to be worked by the scholars. Schools not under the control of the School Board may have the benefit of the system on condition of contributing to the expense. At Liverpool the cost of the apparatus used during five years did not exceed £120. These demonstrations have proved equally beneficial to the teachers and to the scholars. The teachers have been improved in their method of teaching natural science. The scholars, when examined in the subjects of the demonstrations, have shown a remarkable proficiency, and this without any detriment to their other studies.

The foundation of higher elementary schools, sometimes known as “graded” schools, has had good results in Manchester, Sheffield, and other towns. These schools are recruited with the most forward scholars from the common schools. In Manchester all the children attending the graded schools have passed in the Fifth Standard. They are taught French,

drawing, mathematics, physiology, chemistry, physics, and geography. The school fee is only 9d. a week, and there are many scholarships for children entering from the primary schools or leaving for the Manchester Grammar School. The Commissioners stated that they had not seen on the Continent any school which surpassed these in general efficiency or in the tuition in any special subject, except drawing. In a school of the same type, the Central School of Sheffield, all the pupils take the ordinary subjects together with some of the special subjects named in the Code. Both boys and girls throughout the school are taught German. All the girls learn needlework and practise cookery; those in the higher classes take chemistry. Drawing is thoroughly taught, and is made the basis for practical work carried on in the school workshops. This work comprises the production of simple but perfect surfaces and solids in wood and iron, of models and of apparatus for the experimental illustration of mechanical principles. It appeared to the Commissioners that the manual work deserved to be encouraged by grant, and could not well be carried on without such encouragement.

The Commissioners expressed in their Report the warmest approval of these "graded" schools, and a desire for their establishment in all our large towns.* To these and to the system of demonstrations above described they trusted for the diffusion of such elementary scientific knowledge as must form the basis of ordinary technical education. At the same time they insisted on the imperfection of the teaching in science given by the training colleges. They suggested that the training colleges should send up every year to the Normal School of Science at South Kensington, or to similar institutions of established merit, the students who show scientific aptitude. They further recommended that the great School

* It is only right to say that some persons of great experience disapprove of the institution of graded schools, and would prefer to see the higher instruction of advanced scholars given in the same school and by the same masters in which and by whom their elementary training has been given. Their arguments are briefly as follows:—(1) Parents are more easily induced to prolong the attendance of children at an old familiar school than to send them to a new untried one. (2) A child's education is more likely to be systematic and of a piece throughout if entirely given by the same teachers. (3) The teachers are improved both in zeal and in intelligence by having occasionally to give instruction which is not elementary. Considerable weight attaches to these arguments, and it must be owned that the question is one of much difficulty.

Boards should be empowered to found training colleges for day students.

III. *Instruction in the use of Tools.*—Such instruction has been introduced into many, and is to be introduced into all, the primary schools in France. It has been successfully tried at Manchester, and at other places. At Manchester the lessons are given by the School Board carpenter before and during school hours, in rooms separate from the rest of the school, and fitted with joiner's benches and lathes. The boys work one-and-a-half hours a day. The Commissioners recommended that manual work, like modelling, should be included among the subjects on which grants may be earned. The instruction in the use of tools which can be given in a primary school is, of course, very limited. Children of less than ten or eleven years are not strong enough to use tools properly, and older children have scanty time to spare. The lessons cannot be profitable unless the teachers are skilful and the appliances good, and the expense of providing these for a variety of handicrafts is beyond the means of any one school. All that can be done is to give the scholars a chance of making themselves acquainted with the common tools for working wood and iron. Such knowledge is useful to them, even if they do not afterwards become artizans. The work is agreeable as a relaxation from reading and writing. It helps to foster a taste for active industry, and to check the foolish prejudice that the life of a copying clerk is finer and happier than the life of a skilled craftsman.

Seeing how short is the school life of most children, it remains to consider the education given to the workman in purely technical schools. We are not here concerned with workmen who possess unusual talent, scientific, artistic, or administrative—workmen who will, in the natural course of things, become inventors, designers, or organisers. They should be encouraged and assisted to seek the fullest technical instruction. But here we have to do with the common man, and the problem is how to train him so that he shall be able to execute in the best possible manner his common work. Formerly this training was given by the system of apprenticeship; and now that apprenticeship has lost most of the peculiarities which made it valuable as a means of education, it is proposed to supplement the lessons of the workshop by those of the school. To combine these so as to get the happiest result is a task of extreme

nicety. The apprenticeship schools which abound in France, Germany, and the neighbouring countries, vary in efficiency and usefulness; but, as a rule, they have not fully met the wants of the class for which they were designed. A few examples taken from the Report will give a general idea of all. We shall then take a survey of the means of primary technical instruction possessed by our artizans, notice the recommendations made by the Commissioners, and add a few observations upon the possibilities of improvement.

The school of the Boulevard de la Villette, Paris, is intended for workers in wood and iron. The instruction is gratuitous. It comprises a general literary and scientific course, continuing the course of the primary school, together with a special technical training. The technical training combines lessons on the nature of tools, materials, and processes, with practical manual exercises in the workshop. The manual work is divided into two courses: in the first year the pupil spends six hours in the shops daily, and is taught the nature and conversion of materials; in the second year he spends six, and in the third year eight hours every day in the shop, and is busy with actual construction appropriate to the trade which he adopts. The school hours are from seven o'clock in the morning to seven o'clock in the evening, with two hours of interval for meals and recreation. The students pay visits to industrial establishments, and write descriptions of that which they have seen. A large proportion become engine-fitters or pattern-makers, and are said to earn good wages immediately on leaving the school. There are 250 pupils, and nearly £50,000 has been expended on the buildings.

Another apprenticeship school visited by the Commissioners was the Royal Trade School of Iserlohn, in Westphalia, the first school of the kind established in Prussia. The manufacturers of the district were moved to found it by the ignorance of the pupils who entered their works. In this school industrial art suitable to metal work is combined with handicraft teaching. The scholars go through a three years' course, and are trained as designers, modellers, wood-carvers, moulders, founders, turners, and pressers, chasers, engravers, gilders, and etchers. The theoretical instruction includes drawing in all its branches, modelling in wax and clay, the elements of chemical and physical science, mathematics, German, technology, and the history of artistic work in

metal. The practical instruction consists of lessons in the different branches of industry which the pupils are likely to follow, each pupil stating on entrance in which craft he wishes to be trained. In this, as in other technical schools, the hours are much longer than in schools where there is little or no practical work, the alternation of mental and bodily labour giving rest to the different faculties in turn.

Particularly interesting are the apprenticeship schools which have been established in Southern Germany and in Austria for the encouragement of petty manufactures carried on by the peasants. At the present day such manufactures are limited both in number and in extent by the development of machinery, and the consequent development of factories. But if they require the exercise of taste, and if they are carried on by persons who depend largely upon some other calling, such as agriculture, they may still minister to the well-being of great numbers of people. Industries of this sort are wood-carving, clock-making, straw-plaiting and, under peculiar circumstances, some sorts of weaving and pottery. For all these crafts elementary technical schools have been provided in Baden, Bavaria, and Austria. At Furtwangen, in Baden, there is a remarkable school for wood-carving recruited among the peasant lads of the neighbourhood. The scholars first draw and then model the copy before carving it. They pay for the wood, but become owners of everything which they execute. The local authorities provide the building, and the State pays the teachers, besides supplying models, examples, and tools. For literary and technical instruction the pupils all resort to the neighbouring Trade School, and for lessons in cabinet work they frequent a joiner's school. At Arco, in the Southern Tyrol, a school much humbler than the one at Furtwangen proved the germ of a flourishing industry. The people of Arco, who had long regarded olive-wood as fit only to be burned, noticed at last that at Bergamo and other places just over the frontier it was manufactured into many pretty or useful articles. Thereupon the authorities opened a school, with workshops for turning and inlaying; skilful teachers and good examples were procured; the scholars became first expert, and then famous; orders poured in from every quarter, even from America, and now many persons are employed in carving olive-wood, either in the factory or in their own homes.

It is worth while to contrast the skill and ingenuity of the

wood carving done in the districts where these schools have been established with the lack of the same qualities in much of the carving done in Ireland, where the artistic power of the peasantry has not been called forth by instruction. And in this context we may notice an instance of the revival of an old peasant industry by timely artistic training.

In the Erz Gebirge, far from manufacturing towns, the women, to the number of 20,000, earn a livelihood by making lace. At one time the lace made in this district was much admired, and fetched a good price. But fashion changed, and foreign makers undersold the peasants, who could not understand why their lace was no longer wanted, and went on making what they could not sell, until many were at the point of starvation. The Government then held an investigation, established a lace department in the Industrial Art School of Vienna, caused a number of girls to be annually brought up from the country for a three months' course of lessons in designing and making lace, and thus restored comparative prosperity to the unfortunate lace-makers. Instances like these point to the establishment of small technical schools as one of the best means of reducing the poverty and idleness which prevail in some parts of Ireland. People without capital, without knowledge, and without enterprise, must be taught like children. It is perverse pedantry to apply to them maxims of letting well alone which have only a partial truth when applied even to rich, enlightened, and energetic people.

Compare with the Irish pictures which we know too well the following picture from Thuringia :—

“ If the neighbourhood through which we passed is fairly representative of the forest country of Thuringia, it is impossible to overrate the importance, in a material point of view, of these home industries. The cottages were pretty and well kept ; most of the windows contained flowers beautifully grown in pots, and many of the houses had gardens attached to them. The people were well-dressed, and had the air of being well-fed and contented. They are evidently a most industrious race, and their success may depend as much upon their natural disposition and temperament as on the fact that they have been trained for generations in these various occupations. Still, whatever may be the cause of their success in home industries, we think it is impossible to doubt that the influence for good of such work is of vast importance. We found populous and thriving villages, filled with busy workers, in districts remote from railways, and where carriage and transport must be matters of extreme difficulty, and in parts of the country, moreover, where agricultural work would in many cases be wholly insufficient to provide support for more than a small

proportion of the present population. It is in such cases as these that the provision of suitable employment for the masses of the people is so important, and the question of the mode in which such industries are introduced, and the way in which they are fostered, is surely one which deserves the most careful attention of the economist."—"Report," Vol. I., p. 549.

In Belgium the apprenticeship schools give gratuitous teaching, and are supported chiefly by the State and the municipalities. They are open on every evening in the week, and on Sunday mornings. But there is no uniformity in their programmes, which are adapted to the different industries of different places. The general instruction takes in French or Flemish, arithmetic, geometry, the elements of chemistry and physics, technology, the laws of health, and industrial economy. Drawing is the basis of all the technical teaching, and is regarded as the universal language. The drawing lessons follow a graduated course, from drawing lines in chalk on the black-board to the study of projection and ornament, industrial drawing for special trades, and original designing. The course at these schools lasts from three to five years, according to the circumstances of each place. As a rule, the pupils must be at least fourteen years old at the time of admission, and most of those attending at any one time are less than eighteen years of age. Many of the pupils intend to become clerks or draughtsmen, but every class of skilled artisan is represented among them.

Holland has some good apprentice schools, of which the Ambachts School at Rotterdam is a favourable specimen. The general teaching continues that given in the primary school, but extends to all the subjects recognised in the three years' course of the Dutch middle-class schools. Drawing is well taught, always with a view to practice. As regards technical instruction, the boys, as soon as they have learnt the use of tools, begin to make small articles, which can either be sold or else used in the school itself. It is found that they become more industrious by being employed upon work which has a marketable value. The workshops, constantly improved and enlarged, now include shops for carpenters, for blacksmiths, for metal-workers, for fitters and turners, for cabinet-makers, for masons and for stone-carvers. Boys are admitted when twelve years old, and the full course lasts three years. When a pupil has finished his time, the school committee finds him a

situation. The fees, which amount to 8s. 4d. for the year, are readily remitted to the sons of poor parents. It is unnecessary to say that the school is maintained chiefly by the assistance of the Government, the province, and the city.

The provision made in this country for the technical instruction of the artizan may be considered under four principal heads: I. Schools maintained by private firms for the benefit of those in their employment; II. Schools open to the general public; III. Classes organised by the City and Guilds of London Institute for the promotion of Technical Education; IV. Science classes organised by the Department of Science and Art. (The Art Schools under the Department will be noticed in the next chapter.)

I. Under this head are comprised such schools as that established by Messrs. Armstrong at Elswick, or those established by the London and North-Western Railway Company at Crewe, or the school attached to the works of Messrs. Mather and Platt, at Manchester. The last-named school was inspected by the Commissioners, under the guidance of Mr. Mather, who explained its intimate connection with the works. The drawings made in the school are of work actually in progress in the shops. One day the teacher gives the necessary explanations and calculations, and the next day the scholars see, as it were, on the anvil, the very thing which has been the subject of his lecture. The teachers are also employed in the works, know what each pupil is doing there, and readily adapt their lessons to his wants. Thus every arrangement is based on the principle that you must bring the school to the workshop, not the workshop to the school—a thoroughly sound principle, as applied to certain industries like engineering. The school has well repaid the firm for their pains in setting it up. Mr. Mather told the Commissioners that the works had derived from the school an incalculable advantage.

“We desire to send out yearly one or two thoroughly competent men, who shall not be simply mechanics in the ordinary sense of the word, but who shall be able to turn their attention to anything coming under their notice, whether they have done the thing before or not. We had the greatest difficulty in finding such men, until we began to take them from the school; and since the school has been established we have been able to send boys of 20 to 21 to long distances from England, and to place in their hands work which they have not had much to do with before; and by their own intelligence they have made competent teachers of others,

and given the greatest satisfaction. Thus one was sent out only a few years ago not quite out of his apprenticeship, and is now getting £4 per week."—"Report," Vol. I., p. 430.

We can the better understand the value of such a school to a great engineering firm by comparing Mr. Mather's testimony with that given by Professor Ayrton, of the Finsbury Technical College.

"The present workman, to a great extent, is nothing more than a mere machine; he exercises no more independent thought than the chisel or the lathe, and the result is that he becomes deadened, and he works in a careless way, scamping his work and wasting material, the consequence of which is that the price of articles has very much risen."—"Report," Vol. III., p. 116.

But such schools as that maintained by Messrs. Mather and Platt for the benefit of their own establishment can never meet the wants of the country at large.

II. Schools available for apprentices generally are few in this country. The Oldham School of Science and Art is one of the best. The Commissioners described it as an excellent sample of the kind of school which should exist in every industrial town in the kingdom. It had its germ in certain evening classes in science and art commenced in connection with the Oldham Lyceum, and is in alliance with the City and Guilds of London Institute for the advancement of technical education. By the liberality of Messrs. Platt, the school is now housed in a large and handsome building, with chemical and physical laboratories. It is an evening school, with nearly a thousand pupils. The science course embraces practical geometry, machine drawing, building construction, mathematics, mechanics, sound, light, heat, magnetism, and electricity, inorganic chemistry, geology, steam, freehand and model drawing, and technical instruction in tools, mechanical engineering, and the cotton manufacture. The leading manufacturers of Oldham support the school generously, and speak highly of its work. A member of an important firm of engineers told the Commissioners that it got all its foremen draughtsmen from the School of Science and Art. Before the school existed the firm employed Swiss, French, or German draughtsmen. Now there is hardly a foreigner in the town. Another employer observed:—

"The working mechanics are much more intelligent. Now a man can be sent out to work, and can transmit his views to the firm in writing, give sketches, and reason about matters; formerly the man would have

had to return to the works, and get personal instructions in all cases of difficulty. The suggestions they make to remedy defects are more practical than before. *Every man may now be equal in intelligence to what the master was before the school was established.*—"Report," Vol. I., p. 453.

III. The City and Guilds of London Institute has framed a system of technical teaching in its outlines not unlike the system of teaching science established by the Science and Art Department. It enters into correspondence with local committees throughout the kingdom, helps them to organise classes, finds examiners, holds examinations, and makes a capitation grant for successful candidates. The qualification needed for a teacher of any of these classes is partly theoretical and partly practical. He must hold a certificate of honours, granted either by the Science and Art Department or by the Institute, and he must have filled some place, such as that of foreman, in the industry which he professes to expound. The Society of Arts had conceived and, in part, realised the idea of local examinations in technical knowledge, but as it did not pay for results, the results were small. Few candidates offered themselves, even in the few places where examinations were held. Since the Institute took over the examinations, and made them the basis of payment, the centres of examination and the candidates at each centre have multiplied exceedingly. In some places technical schools already existing have affiliated themselves to the Institute, and prepare candidates for its examinations. In other places the classes established with the help of the Institute have grown, or promise to grow, into technical schools. Some disadvantages always attach to a control over education exerted by a central examining body ; but these disadvantages are not to be weighed against the advantages of a uniform standard and a coherent organisation, which the Institute assures to the technical teaching of so many localities, differing so greatly in their knowledge of what constitutes a good technical training, and in their means of providing it. There is some danger lest, for want of skilled teachers, high standards, and adequate resources, our small technical schools may discredit technical instruction altogether. The Institute does what it can to avert this danger. It is now becoming well known throughout the kingdom ; but, oddly enough, when the Commissioners visited Ireland it had not been heard of outside Belfast.

IV. The Science and Art Department does not profess to

give technical instruction in its science classes. But these science classes do more than any other agency to spread among our artizans that elementary knowledge of natural science which is the only possible basis of technical knowledge. The Department has been so long at work, and its methods are so well known to all who interest themselves in education, that any lengthened criticism is needless here. We have only to note the suggestions for increasing its usefulness which were made in the Report. These suggestions, in so far as they related to science, were briefly as follows :—(i.) that School Boards and, in places where there are no School Boards the local authority, should have power to establish, conduct, and contribute to the maintenance of classes for young persons and adult artizans under the control of the Department. (ii.) That the Department should, wherever possible, give a more practical character to the teaching of science, especially in the “honours” stage ; that in the “advanced” stages the payment on results should be increased for all subjects, and that the grouping of subjects should be encouraged. (iii.) That the subject of metallurgy should be broken up into groups of kindred subjects, such as (*a*) the precious metals, (*b*) metals extracted from metalliferous mines, as copper, lead, tin, &c. (*c*) iron and steel ; and that the subject of mining should likewise be broken up into (*a*) coal mining and (*b*) metalliferous mining. (iv.) That the Department should make more effective its inspection of science classes, with a view to ascertain the quality of the instruction and the adequacy of the laboratories and apparatus. (v.) That the Department should not insist on the payment of fees by artizans attending the classes. (vi.) That the grants made by the Department for the building of schools of art or of science should no longer be limited to £500 in each case, and that the conditions attached to these grants should be revised.

Upon a general view it must be owned that with regard to technical instruction for artizans we still have much to learn from our neighbours. At the same time, we possess in the classes of the City and Guilds’ Institute, and in those of the Science and Art Department, two unique and valuable organisations, which, if constantly extended and improved, may supply most of our deficiencies. By undertaking this work later than other nations, we get the benefit of their experience. They have now and then committed the mistake

of trying to teach in the school things which can be better taught in the workshop. They have now and then offered to the artizan an instruction too elaborate for his wants, or given at hours when his work has to be done. Our people are of a practical bent : they can distinguish the knowledge which is useful to them, and if they can most conveniently get it in the workshop they will seek it there. But in our first enthusiasm we may found technical schools for workmen such that workmen will not attend them. The technical school for workmen must teach what workmen want to know. It must adapt its hours and arrangements to their leisure and to their convenience, and must, therefore, be an evening school. A day school which keeps boys of fifteen or sixteen years from their work lays a heavy burthen upon their parents, and the pressure of this burthen provokes an agitation, first of all for the remission of school fees, and secondly for the supply of food and clothing at the public expense. The Parisian technical schools for workmen are, as a rule, open gratis, and in one of them each pupil costs the community £75 a year. A pupil leaving this school at the age of seventeen years would not necessarily or probably be a better workman than a lad of the same age who had spent two years in a good workshop, and had attended evening classes at the Finsbury College or the Oldham School of Science and Art. Even in Paris the schools thus lavishly assisted are not filled solely by young artizans.

The evening school is liable to this objection : that it offers instruction to persons already fatigued with a long day's labour, who may be incapable of application, or at least may feel that they have earned their rest. Yet there is abundant experience to show that evening schools are crowded with pupils, and teach their pupils a great deal. Employers should certainly assist and encourage apprentices to attend these schools. Professor Huxley says, with his accustomed shrewdness :—

“Of all the practical measures that could be taken for the advancement of technical education and scientific teaching the most important would be that employers should show that they valued it, and that they would do something for the young people who in any way distinguished themselves.”
—“Report,” Vol. III., p. 322.

B.—INTERMEDIATE INSTRUCTION

TECHNICAL education, we repeat, must always be considered with reference to education as a whole. The establishment of a complete system of public elementary schools has made it possible to organise primary technical instruction. Intermediate technical instruction cannot be put on a proper footing until we have improved our secondary schools. In England we have asserted the right and duty of the State to secure the efficiency of primary schools by regulation and assistance. But we have hitherto confined the action of the State in respect of secondary schools to the business of ensuring that their ancient endowments, if they have any, shall not be wasted. With this exception we have left our secondary education to the mercy of chance. Any person, however ill qualified, may set up a school for boys of the middle class, and, having set it up, may conduct it as he pleases. No public body undertakes to provide new schools of this order, or to enforce any standard of excellence in those already existing. The consequences are such as we might naturally expect. Test the instruction given in many of the private adventure schools, whether in classics, in modern languages, in natural science, or in drawing, and you will find it thoroughly superficial and unserviceable. Yet these schools exact fees which in France or Germany would be thought high; their masters are ill paid; their buildings, although not so bad as everything else about them, are seldom satisfactory; and altogether the proof is ample that they cannot afford to be efficient, and would not pay if they were useful. Such schools are no fit places of preparation for youths who are to carry on the commerce and manufactures of a great people.

There are, no doubt, many schools whose celebrity offers a guarantee of their quality; but these schools do not aim at preparing boys for intermediate technical education. They educate boys for the universities, for the learned professions, for public life, and for the pursuits of literature. There are many schools inferior to these, yet richly endowed, which have been re-modelled by the Charity Commissioners, and give the preparation here suggested. But the Charity Commissioners have not proceeded in the reorganisation of endowed schools

quite so fast as we could wish. Besides, endowed schools are distributed very unequally over the country. Whilst they are numerous in a small town like Bedford, they are few in a huge city like Manchester. They are naturally most plentiful in those places which formerly were seats of industry and of wealth, places 'almost without exception left to quiet and forgetfulness by the industrial revolution. So that if all the endowed schools of England could be re-organised in an instant, and with full consideration for those studies which naturally lead up to a technical training, even this would not meet all the wants of middle class education.

In order to provide for our intermediate education, both as a whole and in its technical branches, we must call in the help of public bodies. Without this we cannot get a sufficient supply of good secondary schools evenly distributed over the whole kingdom. Such schools, experience has shown, cannot be cheap if they have to defray all their expenses out of the fees paid by their scholars. In order that they may be open, not merely to the children of prosperous men of business and professional men, but to the children of the struggling middle class, they must have help, if not from endowments, then from rates or taxes. The local authorities of counties and boroughs must be empowered to establish such schools, and to contribute to their maintenance. There is nothing unreasonable in this proposal. The rich man, whose sons are at Eton or Harrow, at Trinity or Christchurch, cannot well deny the claim of the shopkeeper to give his sons an education better than he could provide out of his unaided means. The poor man, whose children are educated largely at the cost of the middle class, can scarcely grumble if the middle class receive public help towards its own education. Nor will any wise patriot grudge an expenditure so necessary, in order that the class which fills all but the highest posts in all our industries may hold its own against the corresponding class in France or Germany, educated to the highest point by means of profuse expenditure of public money.

Secondary schools, built and equipped out of local funds, maintained partly by local subsidies, but partly by the fees of the scholars, and inspected by official experts, would differ considerably from the private adventure schools to which the middle class now entrusts its children. They would not supersede the private adventure schools, but they would

kill out all that are hopelessly bad, and drive the rest to become better. These public schools should, of course, vary their curriculum according to the needs of different places. Where there already existed schools enough to satisfy all the demand for a literary education, the new schools should chiefly devote themselves to teaching natural science and modern languages. In other places they might be double—might have two “sides,” as the phrase goes: the one chiefly literary, the other chiefly scientific. The majority of these public schools would correspond with the “real” schools of Germany, and, besides discharging other functions, would prepare lads for that intermediate technical instruction which we have now to consider.

The term intermediate, as applied to technical education, is necessarily vague. Technical education, which must always drive at practice, and adapt itself to all the endless requirements of a thousand callings, does not admit of that clear and simple distribution which may be used in explaining a scheme of liberal education. The intermediate technical instruction discussed in this chapter is an instruction for students of many descriptions, for that minority of gifted workmen whose talent claims more than elementary training, for managers of departments in large works, for heads of establishments who lack time, means, or inclination for an elaborate culture, and for merchants and distributors who find their advantage in having some theoretical knowledge of the goods in which they traffic. Schools meant for the use of such a variety of persons must needs be very various in character. They may be roughly classified as follows:—I. Schools giving general technical instruction. II. Schools giving the technical instruction needed in particular industries. Among these schools we may distinguish building schools, mining and engineering schools, and weaving schools. III. Schools of industrial art. A few remarks respecting each of the above classes will show how rough is the classification even as applied to schools on the Continent. As applied to schools in our own country, it is still rougher. But the absence of concert in our technical education baffles every attempt to classify our technical schools.

I.—Schools giving a general technical education. The lower grade school of this class ranks just above the apprenticeship school—in fact, may be combined with it, as in several English institutions; the higher grade schools

of this class ranks just below technical schools of the first rank, such as the German Polytechnics or the Central Institution at South Kensington. The pupils of the inferior technical school will come mostly from the public elementary schools; whilst the pupils of the advanced technical school will mostly come from the secondary schools. Thus intermediate technical schools may be classified according to the average age for admission in each instance. There will be one set of technical schools for those who wish to begin learning a trade at the age of thirteen years, and another set of technical schools for those who can defer learning a trade until they are sixteen years old. Intermediate technical schools of the lower grade are few in England. In France they are more plentiful. A French example will serve to show what schools of this class ought to be.

The *Ecole Professionnelle Municipale* of Rheims was founded in A.D. 1875, in order to help the youth of that city in getting a practical knowledge of manufactures and commerce. The pupils were to be drawn from such scholars at the primary schools as had passed their examination with credit, but others are admitted on passing an entrance examination in grammar, dictation, and arithmetic. Boys enter the school at the age of thirteen, and the course extends over three years. During the first two years all receive the same theoretical and practical instruction; but in the third year they are distributed, according to their aptitudes, between the sections of manufactures, mechanics, commerce, and agriculture. In this year eighteen hours a week are allotted to practical work in the shop. For the practical work a complete plant has been supplied at a cost of £20,000. In the weaving and spinning department the student can apply his theoretical knowledge to the production of the various textiles manufactured at Rheims. He can spin and weave the wool which he has washed, carded, dyed, and prepared, and can perform each operation in the school with plant similar to that used in the factory. Drawing is taught on a method which appears to produce accurate and rapid draughtsmen. The students in the first year spend three months in drawing from sketches on the blackboard; they then proceed to make freehand sketches of geometrical solids, tools, and parts of machines. These sketches are afterwards carefully figured for dimensions, and from them accurate drawings to scale are prepared. Finally, they produce in the same way

freehand sketches and finished drawings of the objects that they actually make in the workshop. In the second year, seven, and in the third year six, hours a week are devoted to drawing. The chemical laboratories are well equipped, and the scheme of instruction is so carefully arranged that the whole cost of 200 experiments performed by a student in his first and second year does not exceed five francs. A special laboratory is set apart from those students of the third year who intend to enter chemical works, and in this the chemistry of dyeing is taught.

The French schools of this class are highly recommended in the Report.

"In the whole system of French instruction your Commissioners have found nothing, except as regards art teaching, which seems to them so worthy of attention as these higher elementary technical schools."—"Report," Vol. I., p. 84.

In the grade just above that of the higher elementary schools, the grade of secondary schools, properly so called, come institutions such as the technical department of Firth College, Sheffield, or of University College, Nottingham, the *École Centrale* of Lyons, and the Higher Trade Institute of Chemnitz. The *École Centrale* of Lyons is a school for mechanical engineers who wish to complete their education at the age of nineteen or twenty years. The pupils usually become managers and superior foremen. The Commissioners thought that schools of this type might with advantage be established in our large towns. The Higher Trade Institute of Chemnitz in Saxony comprises four schools; a higher technical school for mechanists, chemists, and architects; a foremen's school for foremen employed in various industries; a building school for those who wish to follow any branch of the building trade; and a drawing school for everybody who cares to attend it. The age of the pupils is much the same as at the *École Central* of Lyons. The outlay upon the school may show the value which the Saxons attach to technical instruction. The site and buildings cost nearly £82,000. The annual expenses amount to upwards of £9,000, of which the students' fees hardly cover one-sixth part. The rest is made up by a large subsidy from the State, and a smaller subsidy from the town. The efficiency of this school called forth the admiration of the Commissioners.

II. We now pass to the consideration of schools giving special instruction to persons preparing for some one industry. Among the schools of this class the German building schools form an important group. They are large and admirably appointed, supplied with eminent professors, and so moderate in their fees as to be readily accessible to the thrifty, industrious workman. The Building Trade School of Stuttgart is a fine specimen. It is housed in a magnificent building which cost more than £50,000, and its annual expenses are defrayed chiefly by the State. Pupils are admitted at the age of fourteen years. The instruction is organised in two preparatory mathematical courses and three special scientific courses, designed respectively for those employed in the building trade, for land surveyors and land agents, and for mechanical engineers. The subjects taught include mathematics, physics, general geometry and statics, freehand and ornamental drawing, geometrical drawing, building construction, surveying, mensuration, machine construction, and special drawing for joiners.

"Drawing in all its applications was most carefully taught, and the studies of the pupils evinced a thorough acquaintance with the subject."—"Report," Vol. I., p. 104.

No practical work is attempted in the school, as the scholars are presumed to be already working in the builder's trade. The attendance is always best in the winter, when building has to be suspended. It is instructive to compare this superb building school, situated in a petty capital, with the starved Building Trades Institute of the great city of Manchester.

The metallurgical school of Bochum, in Westphalia, is a good specimen of another class of special technical schools. It was established by the iron and steel manufacturers of the district, who were desirous that their foremen and leading hands should have some tincture of theory to help out the experience gained in the workshop. Only workmen are admitted, and candidates must have been employed for at least four years in iron works or mechanical engineering works. Certificates of good conduct, competence, and elementary knowledge are also exacted. The whole time of the pupils is spent in the school. The course occupies three half-years, the first being devoted to general preparatory study, and the two following either to metallurgy or to the construction of machines, according to the vocation of each student. In the

preparatory class the programme includes drawing, mathematics, physics, experimental chemistry, the principles of the metallurgy of iron and steel, the German language, and the keeping of accounts. In the metallurgical division, these subjects are continued, and the construction of furnaces, smelting, making steel, the analysis of the raw material, and the testing of the finished product are also studied in detail. The mechanical division includes—besides the general subjects—instruction in theoretical and applied mechanics, in the properties of materials ordinarily used in machinery, in the construction of machines, and in the economy of the workshop.

The German building schools are not likely to have any direct result in making more severe the foreign competition which we now experience. The German schools of mining and metallurgy are quite recent; but the German weaving schools call for special notice, as having helped foreigners to rival us in our greatest industries. These schools teach whatever the master, the foreman, or the designer ought to know in reference to his trade, and they also impart to merchants, agents, distributors, and shopkeepers a thorough knowledge of textiles and the construction thereof. The schools are intended, not to supersede apprenticeship in the factory, but to convey knowledge which is not to be obtained save in exceptional factories. As a place in which to learn weaving, the factory is allowed to possess considerable advantages over any school. It is worked for profit—idleness is not allowed—everything is done under the spur of competition, and the necessities of business forbid anything conjectural, antiquated, or needlessly refined. On the other hand, the instruction given in the factory is merely instruction in routine. There is no time to explain the reason of anything, and labour is so minutely subdivided that every hand is limited to the incessant repetition of a single process. In England especially this subdivision has been carried to a degree which forbids the general knowledge of textiles to be obtained in any one factory; we might almost say in any one town.

“Again, there are things not taught in any factory, and hardly to be acquired by the man who is earning his daily bread, which may, nevertheless, be of vital importance to the man of business whose personal aim it is not to execute more and more swiftly some constantly repeated operation, but to find out what the world wants and how that want can best be met.
. . . Fashions can be set or they can be followed, and the student will find

in his industrious experience how capricious and changeable they are ; but experience will also teach him that whoever can satisfy the prevailing taste is sure of customers, and excellence in this respect stands on the same level with good wearing quality and low price. Moreover, this is the variable element, the quality with which calculation and experience of factory management have least to do, the one in which force and versatility carry all before them."

"As is the case in other branches of industry—in pottery and porcelain, glass furniture and metal work—where the higher qualities of design and artistic workmanship have developed trade and brought wealth to the producers, so in textile industry it is the design that sells the cloth. The quality of the fabric may be hard to tell, but every customer forms his own estimate of the pattern printed upon it or woven into it. The wool-comber, the spinner, the weaver may each do his part faultlessly, but if the design is unsatisfactory or inappropriate, or the colour or finishing of the piece ineffective, it will be cast aside by the purchaser as inferior the moment it is displayed on the shop counter against more effective, even though intrinsically less valuable, work. False work, it is true, will not be permanently tolerated, even under the disguise of fair seeming ; but it is folly in a manufacturer to neglect excellence in that department of his work where it tells most and costs least."—"Report," Vol. I., pp. 120-121.

The weaving schools of the Continent aim at giving a general acquaintance with various kinds of machinery and with a number of processes seldom carried on all together, but they aim still more at giving familiarity with the arts of design. Some students have a natural gift for mechanism ; others for art ; but the mechanist learns a little art, and the artist comes to know something about machinery. Among these schools the German ones are pre-eminent ; and, in Germany, those of Mulhausen, Crefeld, and Chemnitz take the foremost place. As they are necessarily much alike, a brief description of the school at Crefeld may convey an idea of all the rest.

Students are admitted to the school at the age of fourteen, if they can pass the entrance examination. The scale of fees is graduated for Prussians, for other Germans, and for foreigners. But the payments are low, a first year's course costing a Prussian only £6, and a second year's course only £9, with an extra fee of £5 for the use of a private studio. There are scholarships which enable the poor student to take the benefit of the school without paying anything. The complete course of instruction extends over two years, but shorter courses may be arranged with the director. The course is divided into two sections—the theoretical and the practical : the first including a thorough study of drawing ; the second including instruction on the loom. Drawing and painting are taught from copies and

models, and from natural plants and flowers, with adaptations to printing and other branches of the textile industry. Due prominence is given to geometrical drawing and the drawing of machines, particularly of those parts of the loom which affect the pattern in the woven fabric. There are also lectures on textile fibres, on the elements of weaving, and on machinery. Fabrics are decomposed and explained, looms are arranged for weaving plain goods or goods with simple designs, and technical calculations and bookkeeping are carefully taught. In the second year lectures are given on the principles which govern the ornamentation of woven or printed fabrics, and the art teaching is continued until the student is able to invent and apply original designs. He is then admitted into one of the studios, where, under the guidance of qualified designers, he is encouraged to give play to his own imagination. At the same time he continues his studies in the decomposition of patterns, and in the composing and calculation of designed materials. He attends lectures on the construction, erection, and action of the looms and other machines used in weaving. He unmounts the power-loom piece by piece, and builds it up again. He works at the forge, and learns the use of the machine and hand-tools in the workshop; he cuts the cards in accordance with his own designs on the paper prepared by his own hands; he fixes the cards in the jacquard machine; and at length becomes thoroughly practised in weaving the most complex patterns, both in hand and power looms.

The weaving school of Crefeld is particularly remarkable for its museum of textile fabrics and patterns; perhaps the finest of the class in Europe. Besides cases of raw material and screens of modern silk and other textile designs, there is the Krauth collection of historical patterns, containing a wonderful variety of valuable specimens. The patterns are so arranged as to assist reference by students and designers. Upwards of 5,000 specimens are kept in glazed frames, which protect them from dust, yet can readily be removed when necessary. Others are arranged in cabinets in their due order from the tenth century to the present time. The school library contains more than 1,200 volumes of well-chosen books on art and the manufacture of textiles. The patent records are supplied by the Government, and the periodical literature includes the fashion papers from Paris and elsewhere. A large sum has been set aside for the purchase of books, and the

library on certain days is open, not to teachers or students from the school only, but to the general public as well.

The dyeing and finishing department of the school is equally complete. Its aim is twofold: to give to those who wish to devote themselves to chemistry an education both in the science and in its practical applications, and to instruct dyers, bleachers, calico-printers, and finishers in the manufacture of dyes and mordants, in the methods of examining and testing the value of dyes and other chemicals, and, lastly, to afford them the means of applying their knowledge to the practice of dyeing, bleaching, printing, and finishing. The buildings include, besides class-rooms, two chemical laboratories, a dyeing laboratory, and a dyeing and finishing house, furnished with new and complete machinery. Collections of specimens and a library are attached to the school. The course, extending over two years, includes the fullest instruction in machinery, drawing, textile fibres, physics, and, above all, chemistry.

Manufacturers are the best judges of the training given in a school of manufactures, and the leading citizens of Crefeld entertain the highest opinion of these schools. They informed the Commissioners that employers are always eager to secure young men who have been pupils there, and that old pupils can turn their knowledge to very good account. To the schools these gentlemen ascribed the extraordinary growth of their silk industry. When asked why the weaving school should pay so much attention to the manufacture of other materials—such as jute, wool, and cotton—they replied that they were anxious to introduce new manufactures as a fresh resource in bad times, and that in any case students who are to become designers or distributors of textile fabrics gain by making themselves familiar with every textile material.

In the Bradford Technical College and in the textile department of the Yorkshire College at Leeds, we have schools which may fairly be compared with the weaving schools of Germany. But a general survey will show at once how few and how ill-provided are our special technical schools. Our general technical schools, although somewhat stronger, are still inadequate. In many of our manufacturing towns the citizens are now making vigorous efforts to amend this state of things. The City and Guilds Institute has undertaken to supply London with intermediate technical

schools, and in the Finsbury Technical College has given a good model for imitation. It is to be feared, however, that English people do not understand the greatness of the task before them. None but thoroughly good technical schools are worth setting up in a country where practical skill is even now plentiful. In order to set up and maintain a good technical school, we must have a well-considered plan and a copious and regular revenue. The best technical schools of France and Germany are at once grand in scale and elaborately wrought in the parts. Every detail has been worked out; every appliance has been provided; whilst a generous ideal has inspired the whole. But these schools have been in many instances founded, and are in all cases assisted by, the State, or by municipal bodies, and have, no less than the primary schools and the universities, their place in a vast scheme of national culture. There is some danger less voluntary effort, unaided and undirected by any national agency, may issue in a crowd of incomplete and ill-organised schools. Another danger is that voluntary effort may not find a steady and abundant revenue to carry on the work of the schools when founded. English people are methodic enough in business, but they are not methodic in education. When they become excited about their intellectual condition, they subscribe a large sum, erect a large building, concoct a programme of lectures, and think the matter ended. In truth the matter is only begun. For a seat of learning a fine edifice, although most desirable, is not the only thing needful. In the present state of knowledge a teaching institution cannot be efficient unless it have a staff so numerous as to allow of a minute subdivision of labour, and unless every member of the staff be really master of his own small province. But in England the demand for experts in applied science to assist in various manufactures is so great, and the salaries offered to them are so high, that they will always be tempted to quit the lecture room for the factory. If they are to sit long in the professorial chair, it must be reasonably well cushioned. The staff of a technical school must be numerous, and it must be well paid; and to this end an ample endowment is necessary. The indispensable equipment of such schools, the apparatus, the museums, and the libraries in cost are second only to the staff. In short, a good technical school is an expensive thing.

For these reasons the assistance of the community will be

wanted to finish the work which individuals have begun. It has been suggested that the School Boards should be empowered to found apprenticeship schools. The local authorities who may hereafter be judged fit to establish intermediate schools for general instruction should also be empowered to establish technical schools of a corresponding rank. Town councils should at once receive the power of making grants to technical schools within their jurisdiction. We have seen how constantly this power is exercised by municipal bodies on the Continent. At a later day, perhaps, the State may assume the business of inspecting and assisting technical schools. In the meantime the London companies would do nobly in enabling the City and Guilds Institute to increase the number and amount of its subsidies to colleges which are giving sound technical instruction. To strengthen the schools we have is even more urgent than to found new ones.

In founding intermediate technical schools we shall not have much help from endowments under the control of the Charity Commissioners. Some of these endowments may be applicable to the provision of apprenticeship schools; but the bulk of them is wanted for schools of a general character. It is an illusion to think that we can have the charge of our technical education defrayed out of the bounty of our ancestors. We must take the burthen upon ourselves, and, after all, it is we, and not our ancestors, who will reap the advantage.

III. Schools of industrial art form a class distinct from all the schools heretofore discussed. It is difficult and, perhaps, useless to draw a line between pure and applied art. It is difficult even to say which is better worth teaching, with a view to technical results. In this country the Science and Art Department began with trying to teach the application of art to manufactures, but now chiefly teaches pure art, and, through its art teaching, exercises a happy influence on our industries. The French have taken extraordinary pains to spread the knowledge of pure art, and find that industrial art takes care of itself. In their art schools the instruction is conformed to the principle that if only you can do enough for art, you are sure to do enough for industry; that if you can cultivate the workman's sense of beauty and power of rendering the beautiful, you will have done the best for his work and for the wealth of the community.

"Drawing is taught from the purely artistic point of view, as this method is thought to be the only one by which the artistic power of the pupils can be encouraged and developed."—"Report," Vol. I., p. 35.

The French schools of art, supported by the State and the municipal bodies, are open free of charge; the buildings are spacious, well arranged, and well lighted; casts and models are lavishly supplied; the masters are skilful and enthusiastic; and the classes are crowded with eager pupils. The course of instruction is extensive. Thus the programme of the *École Nationale des Arts Decoratifs* includes mathematics, architectural construction, freehand drawing and ornament, modelling, drawing from the antique, drawing from life, the history of ornament and decoration.

The School of Fine Arts at Toulouse is well known as one in which a knowledge of drawing is rapidly acquired. The plan of teaching is as follows:—Classes of seven sit round a blackboard, on which the monitor makes a sketch, which is copied on slates by the lads forming the class. There is a special class for monitors—seven or eight in number. From this room the boys pass into the next class, in which they begin to draw on sugar paper with charcoal. Here they draw solid forms (what we should call model drawing), only in lieu of doing freehand work, they are supplied with rulers, and encouraged to rule all the straight lines. The aim in this class is not so much to teach drawing as to teach a correct appreciation of form. The pupils begin with squares, cubes, prisms, and solid rectilinear figures, advancing afterwards to spherical forms and architectural details. When proficient in these exercises, they learn copying from the flat, and then pass into the ornament room, where they make careful studies from lithographed copies of ornament; but some go to the model drawing room, and make shaded studies from solids. They can then commence drawing from the cast, and after a course of fragments, hands, and feet, they turn to the antique. Here the classes are divided, those intending to become painters and those studying as sculptors having each a separate course.

Elementary classes meet from six to eight o'clock on winter evenings, and from six to eight o'clock on summer mornings. These are attended chiefly by apprentices, and contain upwards of 1,000 pupils. Classes in mechanical drawing and projection are well attended. A good library is attached to the school.

In the Belgian art schools the boys begin by drawing geometrical forms with chalk on blackboards, which surround the walls of the room. When they can use the chalk with readiness, they pass on to drawing similar forms with charcoal on sugar paper. From outline drawing they advance to shading from the cast, and in the third year to drawing from the life. This method produces rapidity and boldness of work rather than precision. The Commissioners thought the quality of the drawing thus taught eminently suitable to artisans. The habit of rapid practice imparts such power of drawing as they require in a far shorter time than would suffice under the system adopted in English schools of art. Which of the two systems is better adapted to the needs of the artist may be a more doubtful question.

The industrial art schools of Germany differ from the art schools of France in laying more stress upon the application of art to manufactures. The schools of Dresden and Vienna are good examples of the class. That of Dresden has revived old and established new industries. Its work is to be found in every large shop in the city, and extends to every branch of industrial art. It contains no workshops, but the designs made by the pupils are sold to manufacturers. It is divided into the departments of designing, architecture, decorative painting, ornament, figure drawing, art modelling, and decorative painting from the figure. Besides the work done in the studios, there are lectures on such subjects as anatomy and the history of art. The school library contains 2,000 printed books and 16,000 mounted patterns and examples, together with 11,000 examples of embroidery and lace. It is open to the public, and is visited every year by thousands of persons. The school museum contains 140,000 patterns of textile fabrics of all kinds and of all ages. The director, at the time of the visit of the Commissioners, had studied in the University, in the Polytechnic School, and in the Berlin Academy of Arts. He was also a professional designer in metal work, porcelain, furniture, wall papers, and textiles. He held that schools of this class should simply teach design, without making the objects designed. In the Vienna school a different plan is adopted. There carving, metal chasing, and working in brass and bronze are largely practised. The work done in wood-carving surpassed anything of the kind which can be seen in English schools, and all the workers were qualified to raise the standard

of taste and execution in the workshops which they might enter.

Many of the students attending the industrial art schools maintain themselves by working elsewhere a certain number of hours daily, and selling what they make. These students are generally the most successful, because they have begun to attend the school after two or three years spent in seeking a livelihood have taught them their deficiencies, and inspired them with a wish to improve themselves. In South Germany the Fortbildung, or continuation schools, also serve as nurseries to the industrial art schools, and in them are produced excellent examples of modelling, carving, and smith's work. Thus in Germany, as in France, there is a wide diffusion of artistic taste and skill. Although the application of art to industry receives more attention in the German than in the French schools, yet the experts in both countries are thoroughly agreed upon the principles of artistic education. The German professors declare, with the French, that pure art is the groundwork of all good design, and that a thorough discipline in drawing is the key to an understanding of art.

"If the student has any talent or art-feeling within him, his power of drawing will enable him to give it expression; but without thought and imagination there can be no originality in design. Mere knowledge of drawing will not make a man a good artist any more than knowledge of language will make him a poet; but designer and poet are helpless without the knowledge of the language by which their art can be expressed to others."—"Report," Vol. I., p. 237.

The Germans, like the French, attach more value than we do to rapidity in drawing. One professor, with whom the Commissioners conversed, thought that the free use of charcoal and the stump, as practised in France, encouraged originality, boldness, and dexterity at the expense of precision and finish; whilst the English methods, which laid so much stress on exact outline and careful shading, fostered accuracy, but also timidity. He disapproved of the incessant competitions instituted in the French schools of art, considering that, although they might stimulate the sluggish, they exhausted the finer intellects. "Genius in young men," he said, "needs oftener to be restrained than to be pushed forward, and constant competitions encourage some of the most prominent students to rush by leaps and bounds to the higher realms of pictorial

representation before they have mastered the elementary rules of drawing and colouring." ("Report," Vol. I., p. 239.)

The Commissioners came to conclusions resembling those cited above. They say that in England we do not lay enough stress upon combining rapidity with accuracy of drawing, and they insist repeatedly upon the necessity to the designer of a discipline in pure art. To quote their own words—

"Not until the student is thoroughly master of the various materials and processes by which art is capable of expression, and of the influence of style upon the development of the fine arts, can the student do any good by concerning himself with the varieties of design, and the application of the same to industry. It is at this later period of his training when the designer can be materially benefited by placing before him well-selected illustrations of what the best designers and art workers of previous periods have achieved; and it is here where the influence of industrial museums, collections of patterns, and drawings and exhibitions of art workmanship may exert a most powerful influence for good over the young designer. If, at the same time, we can make his work valuable to him by the actual use of what he is doing for the manufacturer or art workman, and if we can show him, further, how much more valuable his work may become to him in the future by holding out to him the hope of a profitable and honourable career, we shall present the most powerful stimulus to the creation of the future designer. . . The dignity of the designer's work and the importance of the position he occupies are not sufficiently acknowledged in our own country. . . If the value of his labours were only acknowledged. . . the 'artist designer' would soon take his proper rank in the country."—"Report," Vol. I., p. 165.

One of the witnesses examined by the Commission, Mr. Rawle, pointed out the good that the Royal Academy might do by recognising the art of design. The City Livery Companies might with advantage spend their wealth more freely than they have yet done in encouraging designers of talent to produce the highest possible work.

The evidence given before the Commission by several English witnesses confirms and illustrates the doctrines above laid down. Sir Edward Baines said that our paid professional designers obtained the material for their designs by copying from each other. He complained, and Mr. William Morris echoed the complaint, that they lack originality; that they are poor in thought. And Mr. Morris, no follower of outlandish fashions, declared that the French, above all other people, are masters of style in the arts of design. "By mastery of style I mean," he said, "a kind of faculty which enables a man to take certain elements of form and work them into a congruous whole which

strikes the eye at once. In appreciation for beauty," he continued, "in love for beautiful lines and colours, the French cannot be said to be superior to the English ; certainly they are not superior, in matters of colour." If we may put the thing in other words, the Englishman is, perhaps, the equal, possibly the superior, of the Frenchman in artistic sensibility ; but in the logic of art, in the discipline of the creative faculty, he is far inferior to him. Now, a good system of teaching in pure art is just the influence needed to rescue our designers from the bondage of imitation on the one hand, and from the anarchy of their own artistic impulses on the other. Doubtless we have made considerable progress in the arts of design. We are no longer *par excellence* the makers of hideous things ; but we are only beginning our career as artistic manufacturers.

It is said that a famous English firm obtained a prize at the Paris Exhibition of 1878 for a cabinet entirely wrought by foreign artists. A Frenchman had furnished the design, a German had cut the marqueterie, and a German, assisted by a Dane, had done the work of the cabinet-maker.

It is not solely upon the number and excellence of their public schools of art that our neighbours rely for the maintenance of their artistic industries. In almost every one of the large towns of France, Belgium, and Germany may be found a good picture-gallery and a museum either industrial or antiquarian. These galleries and museums are of the utmost service to the local schools of art and industry. The value of a picture-gallery in connection with a school of art is obvious. But the industrial museums are equally valuable to the technical schools. Among all the institutions for technical training which have made Mulhausen famous, none is more prized by the citizens than the museum of textile fabrics.

"Some went so far as to say that they could not see how the trade could in any degree prosper without it. To the designer it is a constant source of inspiration. The museum is to him what the well-stored library is to the literary man, or a collection of the best pictures to a painter."—"Report," Vol. I., p. 354.

The usefulness of similar museums at Crefeld and Dresden has been noticed elsewhere in this summary. In France, especially, the good done by galleries and museums has been thoroughly understood. The municipal bodies and the State work together with private munificence to multiply and enrich them.

The State assists with grants of money and of such objects as can be spared from the national collection. Reproductions of works of art are invariably supplied on any request by local authorities. The control and management of the museums and galleries is shared between the central authority, which appoints directors, and the local authority, which appoints a committee of management.

In England only a few large towns have exerted themselves to diffuse a knowledge of industrial art, whether by means of schools or of galleries. Generally speaking, all that has been done with this object has been done by the Science and Art Department. In furtherance of the work of artistic instruction the Commissioners recommended the following changes. (i.) The abolition of the limit imposed by the Free Libraries Acts on the expense which local bodies may incur for the establishment of galleries and museums of art. One would suppose that in this matter the ratepayers were very well able to defend their own purses. (ii.) The abolition of the maximum of £500 for the grant which the Science and Art Department may make in aid of the erection of local schools of art and museums in connection with them. Not only is this maximum in itself absurdly small, but it does harm by giving the public a mistaken idea of the outlay needed to make these institutions useful. The conditions accompanying even such grants as can now be made are embarrassing, and ought to be revised. (iii.) That the Department should not insist upon the payment of fees by artizans attending the art classes. (iv.) That in the awards for industrial design the Department should attend more than it does now to the applicability of the design to the material in which it is to be executed ; also that the Department should make special grants for the execution of designs under such safeguards as would defeat fraud. Although experts are not all agreed on this point, it seems right, both on artistic and on commercial principles, that the designer should be familiar with and master of the material in which his design is to be executed. (v.) That the Department, which now supplies reproductions of works of art at a reduced cost, and lends collections of the works themselves to provincial galleries and museums, should also grant to them original examples of a nature to advance the industries of the several districts in which they are situated. (vi.) The opening of museums and galleries on Sunday.

These reforms, however, will not have their full effect without the help of individual munificence. England is rich beyond all other countries in private collections of art, and if the fashion of giving were once confirmed, these would be so many reservoirs to feed our public galleries. There is no better or safer mode of bounty than to enrich the community with gifts of this sort. They tend not merely to improve technical skill, but to civilise the whole people, to give them a taste for humane pleasures and a perception of the beautiful, and so, by degrees, to soften and to brighten that dull, hard world which the nation, as a nation, still inhabits.

C.—ADVANCED INSTRUCTION.

THE highest grade of technical education, what we may call the University grade, differs widely in its circumstances from the lower grades. The object of the highest technical instruction is twofold ; first to supply the national industries with the needful staff of experts in applied science, and secondly to supply competent teachers to intermediate technical schools. As the number of persons who can find employment as experts and teachers is comparatively small, technical high schools need not be many, as compared with technical schools of inferior rank ; but, as everything depends on the quality of those teachers and experts, the institutions in which they are trained cannot be too complete or too efficient. The technical education of the common workman should be brought to his door, if it is to be of any use ; the technical education of the student who has means and leisure will be near enough if it is good enough. Therefore, in providing for advanced technical instruction, the essential thing is to have a high standard of what such instruction ought to be. To try to make instruction altogether practical, to be too impatient for results, to exclude the spirit of research and the love of science—this is the certain means to make it poor, shallow, unfruitful, and, in the strictest sense, useless. The technical high school will do no good unless it is liberally planned. The noblest type of such a school is to be found in the Polytechnics of Germany and Switzerland. A very brief description of one of the most celebrated—the Polytechnic of Zurich—will serve to show what our intelligent neighbours think necessary for a

technical high school. We should remember that Switzerland in extent is equal to about half of Scotland, in population is little superior to Yorkshire, does not contain a single large city, and may be termed a poor country.

The Polytechnic is housed in a vast edifice, which forms one of the most conspicuous features of Zurich. It includes seven special schools—of architecture, of civil engineering, of mechanical engineering, of chemical technology, of agriculture and forestry, a normal school, and a school of philosophical and political science. But the magnitude of the foundation will best be understood from the subjoined list of the collections which have been provided for the use of the students:—

1. Several libraries belonging, some to the school, some to the canton, and some to the city of Zurich.

2. Various collections belonging to the engineering and architectural divisions, and consisting of models, instruments, &c.

3. A collection of plaster casts of architectural ornaments.

4. A collection of specimens of construction and of materials used in building.

5. A collection of antique vases.

6. A collection of engravings, about 24,000 in number.

7. A collection of geometrical instruments.

8. A collection of models of machinery.

9. A collection of tools and models attached to the division of applied mechanical technology.

10. A collection of models of raw and finished products attached to the section of chemical technology.

11. A collection of mathematical and geometrical models.

12. A collection of interesting specimens, tools, &c., relating to forestry.

13. A collection of models, implements, and produce in all departments of agriculture.

14. A collection of specimens relating to natural history, zoology, botany, mineralogy, geology, palæontology, and entomology.

15. An archæological collection.

16. A workshop for moulding and casting in clay and plaster.

17. A workshop for metal work.

18. Laboratories for instruction in theoretical and applied chemistry.

19. A special laboratory for agricultural chemistry.
20. A cabinet of physical apparatus and a physical laboratory.
21. An institute of vegetable physiology, comprising a room for microscopic researches, a physiological laboratory, botanical collections, and hothouses.
22. A botanical garden with a museum for the general and botanical collections.

The chemical laboratories having become too narrow for the crowd of students resorting to them, the Federal Council recently voted a sum of £50,000 for their extension. The staff is immense, and at the time of the visit of the Commissioners consisted of forty-five professors and thirteen assistants, exclusive of the tutors and the curators of the museums. An establishment of this magnitude is necessarily expensive. Modest as are Swiss salaries and economic as is Swiss management, the expenses amount to fully £20,000 a year, and of this sum not one-fifth is recouped by fees received from the students. The fees must be low indeed, since those paid by a student of chemistry, including his laboratory charges, do not exceed £12 a year.

A student must be at least eighteen years of age on admission. The length of the course of instruction varies in the various departments of the Polytechnic, but on an average is about three years. The instruction is scientific almost to a fault; thus there is no manual instruction in mechanical work. To quote the words of the Commissioners—

“This renowned school has from its very commencement endeavoured to impart the greatest possible extent of scientific instruction in each of its departments, and its efforts have been to direct thought and research of the highest kind in their application to industrial pursuits, and thus to bring about the necessary mutual interchange of ideas between science and practice; and it has been so far successful that students have come to it from all parts of the world. The Commissioners had the opportunity of judging of the advantages which it has bestowed not only upon Switzerland, but also upon Germany, by the number of thoroughly trained scientific men who have been educated within its walls and who are now holding important positions in various industrial establishments which the Commissioners have visited.”—“Report,” Vol. I., p. 191.

The German Polytechnics in all their essential features resemble the school at Zurich. The services which they have rendered to German industry are unquestionable. Professor Zeuner, rector of the Dresden Polytechnic, pointed out to the

Commissioners that in all the chief industrial centres of Germany the Polytechnic students were filling the posts of managers and directors. To their superior education he ascribed much of the advance of Germany in mechanical industry, and said that whereas Germans formerly purchased locomotives from abroad, they now use only those which they build themselves. Professor Helmholtz very clearly explained not only the general advantage, but also the absolute economy of employing as heads of departments persons conversant with the theory of their work, able to anticipate results and to calculate beforehand the quantity and quality of material required. How could it be otherwise? Here in England Professor Huxley has told us that industry under its present conditions depends almost entirely on either "the application of science or the development of mechanical processes of complexity, requiring a great deal of attention and intelligence to carry them out." But this intelligence and attention most people can exercise only after long training. In those industries which depend on chemistry for their first principles the advantage of the education given in the Polytechnic Schools is most apparent. In England, says Mr. Haeffely, there are very few chemists in print works, and generally the sampler is not a chemist ("Report," Vol. III., p. 2). Yet as a knowledge of art forms the basis of instruction for the designer, so a knowledge of chemistry is the true groundwork for the student of dyeing. Chemical industries, we read in the Report, are assuming more and more a scientific character, and a chemical works is nothing more than a large laboratory in which the victory remains to those who have been most scientifically educated. Reasoning from these facts, the commercial heads of colour works in Switzerland and Germany have been led to the necessity of placing trained scientific chemists at the head not only of the whole establishment, but also at the head of every department in which a special manufacture is going on.

The extent to which the most successful Continental manufacturers employ educated talent may be illustrated from the account given by the Commissioners of the chemical works of Messrs. Bindschedler and Busch, at Basle.

"In the first place," they say, "the scientific director, Dr. Bindschedler, is a thoroughly educated chemist, cognisant of and able to make use of the discoveries emanating from the various scientific laboratories of the world. Under him are three scientific chemists, to each of whom is entrusted one

of the three main departments into which the works are divided. Each of these head chemists, who have in this instance enjoyed a thorough training in the Zurich Polytechnic, has several assistant chemists placed under him, and all these are gentlemen who have had a theoretical education in either a German University or in a Polytechnic School."—"Report," Vol. I., p. 223.

No less than ten well-equipped experimental laboratories, perfectly distinct from the workshops, were available for the researches of these highly-trained chemists, who could also refer to a complete scientific library. Who ever heard of English chemical works so provided?

The number of the Polytechnic Schools of Germany is much in excess of the actual demand for technical instruction. In the early part of this century the Germans found themselves immeasurably inferior in practical knowledge to countries like England. They were obliged to learn in the schools, if anywhere, much that Englishmen could learn in the workshop. Again, a generous emulation moved the States of Germany to vie with one another in making liberal provision for every branch of learning. Lastly, the old Universities, fearing lest the spirit of disinterested inquiry which had hitherto animated their studies might be depressed by the introduction of studies pursued entirely for practical ends, were unwilling to make provision for technical education, and so forced the authorities to found for that purpose independent Polytechnic Schools. Some of these causes have ceased to operate in Germany, and none have much influence in England. Although Oxford and Cambridge will remain, and ought to remain, the seats of liberal learning, cherished for its own sake, many other institutions of University rank, such as the great colleges of the capital, of Manchester, and Liverpool, have departments of applied science, which, if the necessary funds were forthcoming, might be expanded into Polytechnic Schools. The Central Institute at South Kensington might become a true Polytechnic. In short, we have the nuclei of as many technical high schools as we require.

It is true that advantages may be discovered in the total separation of Universities from Polytechnic Schools. The multiplication of seats of learning is a good thing so long as it does not lower the intellectual standard. The rivalry between institutions similar, yet diverse, may be a spur to improvement. The exclusion of technical studies from the University course

may favour the disinterested love of knowledge. But the separation of Polytechnic Schools from Universities involves a considerable waste of money and of power. With the utmost economy we shall barely have money and power enough to put technical education on a good footing. Neither the Central Institution in London, nor the colleges in such cities as Liverpool or Birmingham, are rich enough to increase their staff and their appliances to that degree which is imperatively demanded by the present state of knowledge. The money which we can spare should be spent upon a few great schools, not frittered away among a crowd of petty ones. Besides, we are so differently situated from the Germans that their mode of giving advanced technical instruction is not to be copied by us in every detail. The following remarks by the Commissioners clearly show where we may with advantage depart from German precedents :—

“We should not wish every proprietor or manager of industrial works to continue his theoretical studies till the age of 22 or 23 years in a Polytechnic School, and so lose the advantage of a practical instruction in our workshops (which are really the best technical schools in the world) during the years from 18 or 19 to 21 or 22, when he is best able to profit by it.

“In determining what is the best preparation for the industrial career of those who may expect to occupy the highest positions, it is necessary to differentiate between capitalists who will take the general as distinguished from the technical direction of large establishments, and those at the head of small undertakings, or the persons more specially charged with the technical details of either. For the education of the former ample time is available, and they have the choice between several of our modernised grammar schools, to be followed by attendance at the various colleges in which science teaching is made an essential feature, or the great public schools and Universities ; provided that in these latter science and modern languages should take a more prominent place.

“Either of these methods may furnish an appropriate education for those persons to whom such general cultivation as will prepare them to deal with questions of administration is of greater value than an intimate acquaintance with technical details. It is different in regard to the smaller manufacturers and to the practical managers of works. In their case sound knowledge of scientific principles has to be combined with the practical training of the factory, and, therefore, the time which can be appropriated to the former—that is, to theoretical instruction—will generally be more limited.

“How this combination is to be carried out will vary with the trade and with the circumstances of the individual. In those cases in which theoretical knowledge and scientific training are of pre-eminent importance, as in the case of the manufacturer of fine chemicals, or in that of the metallurgical chemist, or the electrical engineer, the higher technical

education may with advantage be extended to the age of 21 or 22. In the case, however, of those who are to be, for example, managers of chemical works in which complex machinery is used, or managers of rolling mills, or mechanical engineers, where early and prolonged workshop-training is all-important, the theoretical training should be completed at not later than 19 years of age, when the works must be entered and the scientific education carried further by private study, or by such other means as do not interfere with the practical work of their callings."—"Report," Vol. I., p. 514-516.

NOTE ON TECHNICAL INSTRUCTION FOR WOMEN.

THE Commissioners found schools for the industrial and professional training of girls in most of the large towns in the countries visited by them. These schools closely resembled each other. They are intended chiefly for the daughters of small shopkeepers and well-to-do artisans. In most of them the education given in the primary school is continued and supplemented by instruction in one foreign language and in drawing. Drawing is particularly well taught in these schools. At the same time the pupils are taught one or more trades. The technical instruction varies with the habits and industries of the various countries. In almost all the schools needlework and dressmaking are subjects of the first importance. In many of the French schools the girls learn book-keeping, the elements of law, and commercial correspondence. In the German and Austrian schools the technical teaching is almost wholly restricted to plain sewing, embroidery, dressmaking, millinery, laundry work and cooking. In Belgium, Holland, and Italy it includes the making of artificial flowers, the designing of lace, painting on fans, glass, or porcelain, typography, telegraphy, and pharmacy. Many of the pupils pay substantial fees, but some hold exhibitions from the primary schools. Inquiry showed that the education given in these schools was thoroughly practical, and enabled many young women to find suitable employment without having to leave their homes.

The Royal School of Art Embroidery at Vienna is entirely technical. Girls seeking admission must be at least fourteen years of age, and must have completed their education at the primary school. They must be able to draw, and must have a thorough knowledge of plain needlework. The course of instruction extends over five years. All the pupils are taught

freehand drawing. They have to prepare written accounts of the lectures given by the professors. They are taught every kind of fancy needlework and designing for needlework, and at the end of each year they work samplers, to show their proficiency. Foreign students have to pay fees, but natives are admitted free of charge. Many of the girls become teachers in Austria and in other countries. The directress, at the time of the visit of the Commissioners, was a lady whose books on the subject of embroidery are regarded as standard works. The Commissioners thought the instruction given here the highest which they had found given in any school of the same class.

The Embroidery School of Vienna is a special school devoted to the cultivation of one art. But technical schools for women, somewhat more general in character, might with advantage be established in our large towns. In such schools the morning hours would be devoted to the study of languages, drawing, and elementary science, and the afternoons would be set aside for practical instruction in some industry. At present the art schools afford almost the only means which women have of learning a craft whereby to support themselves; but the art schools are overcrowded, and few women are meant by nature to be artists. If it is urgent to open up new pursuits for men, how much more urgent is it to open up new pursuits for women? Above all, women should have every means of becoming skilled in industries which can be combined with domestic life.

III.—TECHNICAL INSTRUCTION IN AGRICULTURE.

GRAVE difficulties beset the improvement of agricultural education. Agriculture is practised by men who believe much in tradition and little in science. Country people, living apart from one another, are less capable of concerted voluntary action than are the inhabitants of cities. The administration of our rural districts is certainly not framed so as to supply the lack of spontaneous energy. Just now these districts are somewhat impoverished and particularly averse to paying new rates. All these considerations limit the range of practical proposals for giving that technical instruction which has become more than ever necessary to the prosperity of English agriculture.

Having quite enough to do in other branches of the inquiry into technical education, the Commissioners assigned the agricultural branch to their Sub-Commissioner, the late Mr. Jenkins, Secretary to the Royal Agricultural Society of England. Mr. Jenkins drew up a report, which will be found in the second volume of the Report of the Commission, and which gives a full view of the methods of agricultural education adopted in France, Germany, Denmark, Holland, and Belgium, as well as in the United Kingdom. In this respect all these countries differ extremely from one another. The agriculture, and therefore the agricultural education of every country, varies with the varying physical and economical conditions, so that foreign examples are to be used more cautiously in this than in any other department of our inquiry. Here it will be enough to note what has already been done in the United Kingdom to further agricultural instruction, and what recommendations for its advancement have been made by Mr. Jenkins and adopted by the Commissioners.

What has already been done may be briefly summed up. In England the State has recognised instruction in the principles of agriculture as instruction in elementary science, which may be taken up as a class subject in elementary

schools. It has established an agricultural department in the Normal School of Science, has appointed a professor of agriculture, who lectures at South Kensington, and has provided for the formation of an agricultural class in any place which may desire to have one. In Scotland the agricultural instruction given in elementary schools is much the same as in England. The State pays a small stipend to the Professor of Agriculture in the University of Edinburgh. In Ireland the authorities have done more than in England or in Scotland. The principles of agriculture are taught in the elementary schools; but they are better taught, because the National Schools Board has a model farm at Glasnevin, near Dublin, where teachers in elementary schools receive practical instruction in agriculture; and many of the schools under the Board have school gardens or small farms, where the teachers can illustrate their agricultural lessons and accustom the pupils to agricultural work. The Munster Dairy School is also a Government institution. Other agricultural schools were formerly maintained by the State, but were sacrificed to what many consider a mistaken policy.

Something has been done, too, by agricultural associations and by private enterprise. The agricultural colleges at Cirencester and Downton give an excellent training to those who can afford to pay heavy fees. The Royal Agricultural Society of England, and similar societies in England and elsewhere, hold examinations and give prizes to the candidates who distinguish themselves. By means of their journals, by exhibitions of live stock and agricultural produce, and by various other expedients, these societies do much to extend the farmer's professional knowledge and to sustain his professional enthusiasm. The experimental farm at Rothamstead, founded and endowed by Sir John Lawes, is a unique and magnificent laboratory of agricultural research. But, after taking account of all these agencies, it may be said that the technical education of the ordinary farmer—English, Scotch or Irish—is almost wholly empirical, and his technical skill the result of extreme subdivision of labour.

The recommendations made by Mr. Jenkins for the improvement of technical instruction in agriculture may be summarised under the heads of primary, intermediate, and advanced instruction. Primary instruction in agriculture is for the farm labourer, farm bailiff, or small farmer. To

some extent this instruction could be given in the public elementary schools of country parishes. Agriculture should be made one of the compulsory subjects in rural schools. Each school should be provided with a garden proportioned to the number of scholars, and in this garden they should be employed for a certain time every day. Together with this practice, they would have a series of elementary lessons on the principles of agriculture. Children in the first three standards would have lessons on the common objects of rural life, the familiar animals and plants of the country. In the higher standards they would study these in particular reference to agriculture. They would also study the construction of farm implements and simple agricultural machinery, and of simple mechanical and physical apparatus, such as the lever, pulley, wheel and axle, spirit level, barometer and thermometer. This obligatory course would take the place of the optional course in the principles of agriculture which is now comprised under the title of elementary science. On the above scheme every child going to a country school would obtain some insight into the principles of agriculture, and the common labourer would cease to be merely a living tool.

But for the clever lads of the labouring class who might hope to rise higher, and for the sons of the small farmer, a further training would be necessary. For these Mr. Jenkins proposed a new system of instruction, suggested by the French farm schools. He stated his plan as follows :—

“In each county there should be selected a good farm, the tenant of which would agree under certain terms to take agricultural apprentices for a term of, say, two or three years, according to the age at which the apprenticeship commenced. On most grounds I should prefer an agricultural district to a county as the definition of the area, but as the county is the only local unit in country districts which calls forth local energy, it is necessary to select it for my present purpose. It would be a great advantage if to each farm there could be attached a teacher capable of continuing the general education of the apprentices by lessons given in the mornings and evenings, but the remainder of whose time might be otherwise employed, according to local circumstances, for instance—as rate-collector, book-keeper, &c.—or he might also be teacher during the remainder of the day at some neighbouring school. He should be capable of teaching the elements of chemistry, land-surveying, book-keeping in a simple way, and the elementary principles of agriculture. Most of this technical instruction could be given during the winter evenings, and the apprentices should be entitled to pass the examinations of the Science and Art Department in the same way as the pupils of science classes, if they

desired to do so, and to earn for themselves and their instructors all the distinctions and rewards that are given to pupils and teachers in elementary schools and science classes.

"I am not inclined to follow the French system in requiring that all the farm labour should be performed by the apprentices; on the contrary, in my opinion it would be better to limit their number to a manageable one, according to the size of the farm, say, from three to six in each year. This number, with an apprenticeship of three years, would make a maximum of from nine to eighteen on the farm at any one time; and of course the older apprentices would, or at least should, be worth more as workmen than the ordinary farm labourers.

"The apprentices should be selected from those who distinguish themselves most in an examination held annually in connection with that of the Science and Art Department; and to a great extent, or perhaps entirely, the same papers might suffice for both examinations. . . . If the number of elementary school scholarships and of science and art scholarships were increased with a view of encouraging such farm schools, by making a certain number of the scholarships tenable at them, they would be more likely to be established and to work successfully. . . . During their stay at the farm school the apprentices should be compelled to pass an annual examination in practical as well as theoretical subjects, and prizes might be given for proficiency; but in the event of any of the apprentices being found deficient in knowledge up to a certain point, their apprenticeship should cease. At the termination of their apprenticeship they should receive a certificate of proficiency according to merit.

"In a somewhat similar manner girls not less than 16 years of age might be sent to learn dairying and household work at selected dairy farms, such as those which abound in Germany and Denmark.

"I would suggest that a period of three months should be the minimum, but that a complete season of from, say, the middle of March to the middle of November would be much better.

"My impression is that a sufficient number of good farmers would be found to take farm apprentices and dairy apprentices from public elementary schools in their own locality or county upon terms that would fairly reimburse them for two accessory reasons:—(1.) They would be contributing to remove the present inefficiency of the farm labourers and dairy-maids in their districts, and (2.) They would be likely to receive as pupils sons of wealthy people, at highly remunerative terms, in consequence of their farms being recognised as 'County Farm Schools.'—*"Report,"* Vol. II., pp. 316-318.

In consequence of the recognition of agriculture by the Science and Art Department, many agricultural classes have been established in various parts of the United Kingdom. These classes resemble in their organisation the classes in science and art so often mentioned in this summary. They are usually held in market towns and in the evenings. Mr. Jenkins was of opinion that "very few indeed of these teachers can give instruction in objective agriculture. They may have

learnt the words of the language, and they can teach them, but they do not know their signification: in fact, they cannot translate them." But he allowed that "some of the teachers are thoroughly well-qualified men, and do really good work." ("Report," Vol. II., p. 231.)

The education of the teachers themselves must determine the usefulness of their teaching, and their education cannot be complete until it includes a regular course of practical work on a farm, for which apparently provision has not yet been made. If the farm schools suggested by Mr. Jenkins were in operation they would afford practical instruction to those who wished to teach agriculture under the department, and the apprentices at the farm schools could get scientific instruction by going to the lectures of the teachers. In this way the lower and intermediate instruction of farmers would attain a fulness hitherto unknown. But so long as a course of practical lessons is not included in the qualification of a lecturer on agriculture he will be of little use, and will inspire less confidence. The agricultural course of the schools of science at South Kensington might also be made more strictly professional than it is at present; but of this we shall have to speak a little later.

We next come to intermediate instruction in agriculture suitable for the ordinary tenant farmer, farm steward, or land agent. The obstacles to the spread of this instruction arise partly from the nature of agricultural education itself, but still more from the bad state of secondary education, and the absence of any energetic administrative power in the counties. Those who are to receive intermediate instruction in agriculture ought to receive also a good general education. Whether they can do this at present depends on the accidental distribution of efficient schools. In most districts such schools are scarce, and the education of the tenant farmer is exceedingly defective. Anybody who knows the rural parts of England can recall cases of men who farm, say, three hundred acres each, and in general culture are little, if at all, superior to an intelligent artizan. The education of the middle class in the country, even more than in towns, will never be put on a thoroughly sound footing without help from local authorities, such as do not yet exist in the counties. Given good middle-class schools, we have yet to find the means of imparting agricultural together with general instruction. For men must

begin to farm early in life if they are to like farming or to become able farmers. Mr. Jenkins suggested that in each of the chief middle-class schools in rural districts there should be established a farming department with a farm of perhaps one hundred acres attached. On this farm all the principal kinds of agricultural produce would be raised, and the boys would in turn share in all the branches of work. Everything should be conducted in a practical manner, and a skilled director of the farm would be necessary.

It is admitted that there would be some trouble in finding the means needed to carry out this scheme. The school-farm ought to pay its expenses, and yield a profit, otherwise it would not be a place in which to train practical farmers. But the first outlay upon it would be considerable.

"If we suppose that the school-farm has an area of one hundred acres, it would be desirable to provide under all the circumstances a working capital of £20 per acre, or say £2,000. In some cases it would be necessary to spend money in either a farm-steading or a house for a farm manager, who should be the working bailiff; but it is impossible to give any estimate on this head. Extravagance, however, should be distinctly prohibited, and a complete set of new farm buildings should not be allowed to cost more than £10 per acre. Additional annual expenditure would be required for the salaries of the agricultural teacher and the farm bailiff, and for the maintenance of the experimental field (for purposes of demonstration only) and the botanic garden. An allowance of £500 per annum would be amply sufficient for these purposes, and would leave a margin to be spent in gradually increasing the means of instruction, such as natural history collections.

"Scholarships and exhibitions would, of course, diminish the amount of money available out of the profits of the farm towards the payment of the items just mentioned. After a few years' experience, and by keeping a reserve fund, any rewards drawn from that source might be rendered tolerably equal."—Report, Vol. II., p. 314.

Mr. Jenkins suggested that the county in which such a school was situated might raise by subscription the capital sum necessary for its equipment, if the Government would contribute to the building fund such a grant as it now makes for the erection of a school of science. Subscribers of not less than a certain sum might be rewarded with the privilege of nominating a pupil to be received for half the usual fees. The exhibitions granted by the Crown in the existing science schools might be made tenable at a farming school, and the Crown might annually grant a scholarship tenable at the Normal School of Science, or at the Agricultural College of

Cirencester or Downton, to the best pupil in each of the farming schools.

Agricultural education of the most advanced kind is more flourishing than primary or intermediate agricultural education, because the class which wants it can afford to pay a heavy price for it. The agricultural colleges of Cirencester and Downton are able to meet all their expenses, and are doing their work well. They are attended chiefly by the sons of landowners and of tenants of the largest farms. They charge fees, indeed, much beyond the capacity of the ordinary farmer's purse. But experience has shown that the ordinary farmer, even when scholarships are available to meet the expense, distrusts a technical training continued to so late a time in life. He prefers to put his sons to work before they have reached the age of twenty-one or twenty-two years. His judgment is probably justified in the majority of cases. For the minority, for the boys of unusual talent, and for the fathers of unusual ambition, the suggested Queen's Scholarships would provide. There would be no use in taxing the public to multiply scholarships or reduce fees at the agricultural colleges merely for the benefit of the sons of rich men.

For a supply of teachers of agriculture we should be able to look less to the agricultural colleges than to the agricultural department of the School of Science at South Kensington. Mr. Jenkins found several faults in the course of instruction given there. He thinks it unduly prolonged, and would reduce it to three years; he thinks it too much burthened with non-professional subjects, and would omit some of these, imposing an entrance-examination to test the general knowledge possessed by candidates for admission; and, finally, he thinks that it is not practical enough, that it embraces too many lectures and too few demonstrations.

No scheme of technical instruction in agriculture would be complete unless it made provision for teaching forestry. Great Britain and Ireland contain large tracts of desolate land which might be planted with valuable timber. Some of the commonest trees are almost worthless, and might be replaced with more useful species. Our older colonies already feel the bad effects of the reckless destruction of forests. The Governments of India and Cyprus have dedicated a branch of the public service to the preservation and management of the forests.

Every enlightened country of the Continent has one or more schools of forestry ; but the whole subject of forestry, as it concerns the United Kingdom, is now under the consideration of a Select Committee of the House of Commons, and it seems better not to anticipate the conclusions which they will be able to found upon the fullest evidence.

IV.—CONCLUSION.

WE have now taken a rapid survey of the whole field of technical education. It only remains to sum up, as briefly as possible, the results of this survey.

In the first place, technical education, although a most important branch, is only one branch of national education. If national education is bad, technical education cannot be good. Neither the workman, nor the foreman, nor the designer, nor the employer can profit by a technical training unless he has first been trained to use his mind and to feel pleasure in using it. Technical training merely directs into the channels of the various industries that activity of intellect which is called forth by a good general training in literature, science, or art. The first step, therefore, in establishing a complete system of technical education is to supply as far as possible all deficiencies in our system of general education; and more especially to perfect our elementary and intermediate schools.

In the second place, schools established to give special technical instruction must be carefully suited to the wants of the particular trades for which they are intended. They must give really useful instruction, and give it in such places, at such times, and generally in such a manner as to be available to all who would like to profit by it. If the instruction is to be really useful, it must be made as thorough and scientific as possible. The indifferent technical school will soon be found out, despised, and deserted. Our manufacturers and agriculturists already know too much to take lessons of bad teachers. If we cover the country with third-rate technical schools, we shall find, too late, that we have spent our money and our pains merely in strengthening that distrust of theory which is already too strong in the half-educated Englishman. We shall have wasted the season of enthusiasm and destroyed the hopes of technical education. At the same time, the technical schools must accommodate themselves to the circumstances of industrial life. Especially the primary technical school must be accessible, cheap, and practical, or it will not attract the common workman, with his small surplus of time, money, and

energy. The higher technical school is not bound by such strict conditions ; yet it must constantly keep in view the needs of industry. It must so contrive its courses of science and art that they shall not clash with the empirical training which can be had only in the factory or the workshop. Extremely difficult is the reconciliation of theoretical with practical instruction ; but upon this reconciliation the whole usefulness of a technical school depends. And it must be remembered that utility, as distinct from culture, is the aim of every technical school.

Thirdly, we must remember that a good technical school cannot be a good commercial speculation. Its buildings, its equipment, its teaching staff, all are costly, and their cost cannot be recouped out of fees paid by scholars, for high fees would exclude those who must form the bulk of the scholars at all but a few technical schools. Not only must the expense of establishing a technical school be defrayed either out of voluntary subscriptions, or out of rates and taxes ; but the expense of maintaining it must, in a considerable degree, be defrayed from the same sources. The income derived from fees must be supplemented with a further income more permanent and trustworthy. The wise founders of old time did not exhaust their bounty in building ; they also provided for the sustenance of the schools and colleges which they founded ; and each school or college, having proved its worth, contrived subsequently to supply what might at first have been wanting to the size or splendour of its home. Modern founders, in their anxiety to leave handsome monuments, too often forget to provide a fund for maintenance, and leave an institution to feel the full severity of a struggle which cripples its usefulness, or even shortens its life. As the flow of subscriptions sinks or swells with the national prosperity, and with the passing fancies of the public mind, a technical school should always have an endowment, and if it has no endowment, it should, on fulfilling reasonable conditions, receive a subsidy from local or imperial funds.

Lastly, our technical schools must be brought into relation with one another and with schools of other descriptions. If they are left without co-ordination, some of the work will be done twice over, and much of the work will not be done at all. This co-ordination is almost impossible unless we establish a centre of knowledge and of power in reference to technical,

such as we have already established in reference to elementary, education. Voluntary effort can do much, and to it we must chiefly trust. But if voluntary effort cannot guarantee to all the technical schools in the kingdom a revenue adequate to their needs, still less can voluntary effort assign to each of them its right place and function in a scheme of technical training adequate to the necessities of the greatest industrial society in Europe. Soon or late the Government will be forced to inspect and to assist technical schools. It is possible so to contrive this inspection and assistance as not to dry up the stream of private liberality. The experience of other countries, and of our own, the public spirit shown by rich men in France and Germany, the magnificent gifts made to such institutions as the Museum at South Kensington or the National Gallery, all tend to show that private munificence can be led to flow copiously in the channels provided by public authority. It is natural that this should be so. The desire of connecting their names with great and durable institutions, of the assurance that their gifts will be well employed, encourage men to acts of liberality which they would not perform for a merely transient object or under a depressing uncertainty as to whether they could effect any good at all.

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